JOURNAL

OF

THE MINING SOCIETY

OF

NOVA SCOTIA.

VOL. II,

PARTS I, II, III & IV.

BEING THE TRANSACTIONS OF THE SOCIETY DURING THE YEAR 1893 - 94.

EDITED BY THE SECRETARY.

COPIES OF THIS VOLUME AND ALL THE SOCIETY'S TRANSACTIONS MAY BE OBTAINED ON APPLICATION TO THE SECRETARY

AT

THE ROOMS OF THE SOCIETY,

129 HOLLIS STREET, HALIFAX.

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TRANSACTIONS

OF

The Mining Society of Nova Scotia.

VOL. II. SESSIONS 1893-94. PART I.

The Second Annual General Meeting of the Society was held in the rooms, 129 Hollis Street, Halifax, on Wednesday, 29th March. Among those present were: H. S. Poole, M.A., F.G.S. (Acadia Coal Co.), Stellarton, N.S; John E. Hardman, S.B., M.E., Oldham, N.S.; Capt. Geo. MacDuff, Waverley, N.S.; A. A. Hayward, Waverley, N.S.; J. M. Reid, Oxford Mines, Musquodoboit, N.S.; C. E. Willis, Halifax; B. C. Wilson, Waverley; Chas. Archibald, Cow Bay; J. H. Austen, Halifax; W. G. Matheson, New Glasgow, N.S.; Wm. Smaill, Londonderry; R. G. E. Leckie (Torbrook Iron Co.), Torbrook; Alfred Woodhouse, F. G. S., Montagu; Geoffrey Morrow, Halifax; G. E. Francklyn (General Mining Association of London, Ltd.), Halifax; Duncan McDonald, Truro, N.S.; George W. Stuart, Truro, N.S.; T. R. Gue, Halifax; Alfred Dickman, Halifax; D. W. Robb (Robb Engineering Co.), Amherst; Howard Clarke, Halifax; C. S. Harrington, Halifax; W. R. Thomas, Montagu; Dr. Gilpin, Deputy Commissioner of Mines, Halifax; W. H. Huggins, Halifax, and H. M. Wylde, Halifax, Secretary.

MR. H. S. POOLE, M.A., F.G.S., President, who occupied the chair, called the meeting to order at 10.30 a.m.

THE SECRETARY read the minutes of the regular Quarterly General Meeting, held in December, and of the special meeting held in Montreal during the sessions of the International Mining Convention.

MR. JOHN E. HARDMAN—It would be well to add to the minutes of the Montreal meeting that the Government had acceded to the request of the Society "that the Province of Nova Scotia should be represented at that meeting." The Government of Nova Scotia were perfectly willing that Dr. Gilpin should attend, but owing to pressure of business Dr. Gilpin could not get away, and as a matter of fact all the members who were present at Montreal know that the Premier, the Hon. Mr. Fielding, was present and represented Nova Scotia admirably. I beg to move that the minutes be amended in this respect, and that it be placed on record that the Government acceded to our request.

On motion the amended minutes were approved.

The following names for membership were handed in: Mr. A. Drysdale, Mr. Graham Fraser, Dr. James McKay, Mr. Herbert Dixon and Mr. C. F. Andrews.

Upon motion of Mr. Willis, seconded by Mr. Chas. Archibald, these gentlemen were duly elected members.

THE PRESIDENT—The Council recommends, in regard to Volume I., Part I., of the Transactions, which has not yet been printed, that it be issued and embrace all that has been made public relating to the formation of the Society, including the notes in regard to coal legislation and matters relating to the agitation of a year ago. Will anyone move that the recommendation of the Council be adopted?

On motion of Mr. Hardman, seconded by Mr. Howard Clarke, the recommendation of the Council was adopted.

THE DUTY ON MINING MACHINERY.

A letter from Mr. B. T. A. Bell, Secretary of the General Mining Association of the Province of Quebec, under date of 24th March, with reference to the Customs regulations relating to the imports of mining machinery was read.

THE PRESIDENT—The idea of the Council was that a committee should consider the matter and report at our next meeting.

MR. C. E. WILLIS—If there was any serious action taken on this subject and a list furnished the Department it might be the means of getting us into a bad trap. There are new machines being manufactured every day, and if we furnish the Government with a statement, we might leave out these. This is a matter which should be looked into very carefully.

THE PRESIDENT—We could have on our committee such men as Mr. W. G. Matheson, of New Glasgow, and Mr. D. W. Robb, of Amherst, who are in a position to say what machinery was manufactured in Nova Scotia. The list to be furnished the Government would only have to include such articles as can be supplied in this country.

MR. C. E. WILLIS—If we make a statement will the Department confine us to only those items which are contained in it?

THE PRESIDENT—The list would only show such as are manufactured in this country.

MR. W. G. MATHESON—The idea which I have got is this: —not a list of articles that pay duty, but a list of articles that are *not* to pay duty, so that the statement would include any machinery made abroad.

MR. HOWARD CLARKE—I think the simplest way would be to make a list of what is manufactured in the Dominion, and have all other machinery admitted free. A list of what is manufactured here could be easily made out.

MR. JOHN HARDMAN—Let us make a list of what shall be charged duty and not a list of what is *not* charged duty.

MR. CHAS. ARCHIBALD—Would it not be possible for the Government to arrange with the different Collectors of Customs to pass machinery which was not manufactured in this country upon the party making a declaration to that effect?

THE PRESIDENT—That is the law now. You have got to make an affidavit that it is not manufactured in Canada.

MR. CHAS. ARCHIBALD—It would be a difficult thing to make a list of all that is made.

MR. JOS. AUSTEN—In making the affidavit under the law now, we not only have to state to the best of our knowledge and belief that the article is not made in Canada, but that it is mining machinery, and that it is to be used in a specified mine. That is the form of the affidavit we have to make.

MR. JOHN HARDMAN—This matter came up in the meeting of the Quebec Association in February. It was then stated that they did not get the same ruling from Collectors of Customs in the Province of Quebec, that we get from the Collector of Customs in Halifax. The Collector would not take their affidavit as to whether or not it was mining machinery, and the Quebec Association desired to have the interpretation of the law taken out of the official's hands.

MR. T. R. GUE--I think we would undertake a large contract to make a list specifying all kinds of dutiable mining machinery. I would make a suggestion that it is too far reaching to cover all. The President spoke of Mr. Matheson and Mr. Robb, whose business is making mining machinery quite largely—could they not specify what is made here, by themselves and others, and the Secretary could correspond with the manufacturers in British Columbia, and Hamilton elsewhere, and make a report? Of course such a report would cost them considerable time and trouble—but as those gentlemen are interested in the manufacture and sale of mining machinery in this Province, they could make such a list. The Government would scarcely question anything that the Collector did who conferred with this

committee. If you do anything else I am afraid it will not have the effect we want it to have, and will not be far reaching enough. These men are interested in the manufacture of mining machinery and they are not going to report for free entry upon machinery they can make here. If you put it on that ground I think you will get it in a shape the Government will not undertake to question. The things the committee recommend should be free. The only question is, are the gentlemen to be named willing to devote their time to making a complete list? I think they will.

MR. J. M. REID—I have been importing machinery for the last two or three years, and I find a great deal of trouble getting it in, whether of a class manufactured in Canada or not, and several times I imported machinery not manufactured in Canada, which I did not succeed in getting in free of duty. If we can get up a list of what shall not come in free we have got a big contract before us, but if we get up a list of what shall come in free we have the list.

MR. JOHN HARDMAN—This is a matter which would be discussed much better in committee than by the whole Society: I move that the matter be referred to a committee to be appointed by the President.

MR. CLARKE—I second the motion.

MR. J. M. REID—I wish to be placed on record against furnishing the Government with any list.

The motion upon being put was duly carried.

The Chair then appointed the following gentlemen to form the committee:

Messrs. T. R. Gue, Geoff. Morrow, Jos. Austen, D. W. Robb, W. G. Matheson and Duncan Macdonald, with power to add to their number.

ELECTION OF OFFICERS.

THE SECRETARY—It would be well, in order to expedite business, that the Chair appoint a committee to take the nominations received, and report a slate suggesting the names of the officers and council for the ensuing year, as the first business of the afternoon session.

Upon motion duly passed the Chair appointed Mr. Smaill, Mr. Austen and the Secretary.

JUNE MEETING, ETC.

THE PRESIDENT said the Council hoped to be able to announce that the June meeting would take place in Pictou County, with excursions to the iron works, steel works and some of the collieries in that neighborhood. He then called upon Mr. W. G. Matheson to read his paper on Fuel Economy, regretting that the text of the paper had not been received in time to have it printed. Mr. W. G. Matheson then read a paper on the subject of Fuel Economy. A vote of thanks was duly tendered Mr. Matheson for his valuable paper, the President remarking that if the Society published no other paper in their *Transactions* for the year, members would get more than the value of their dues in the practical suggestions it contained. Discussion on the paper followed. This was followed by a paper by Mr. B. C. Wilson, entitled: "Notes on some Special Features in Lode Formation and deposition of Gold as presented in the Waverley Gold District." A vote of thanks to Mr. Wilson was passed, and the paper was discussed by members present.

The meeting then adjourned until 2.30 p.m.

AFTERNOON SESSION.

The members assembled in the rooms at 2.30 p.m.

A letter was read from Mr. J. R. Lithgow resigning his office as Treasurer to the Society. The resignation was accepted with regret.

REPORT OF COUNCIL FOR YEAR 1892-93.

The following report of Council for the year 1892-3 was submitted and adopted.

The Council for the past year beg to submit the following report of what has been done by this Society during the past year.

The number of members who joined at the inception of the Society was 58, and other 17 members were elected during the year, making a total of 75, of whom only three have resigned their membership.

Briefly stated, the Society's income and expenditure during the past year has been as follows:—

Receipts — Balance received from Gold Miners' Association in lieu of fees of 18 members of that Association	$15 43
Subscriptions collected for 1892	487 75
Total....	$553 18
Expenditure—As per Treasurer's Statement	$438 05

leaving a credit balance on 1892 account of $115.13 The subscriptions due and not yet paid amount to $25.00, of which $15

is placed as good and $10 as not collectable. The estimated income for the current year is $720.

Meetings—Since its organization the Society has held four regular meetings and one special meeting—and while referring to this, the Council desire to call attention to the very enjoyable quarterly meeting held at Londonderry on Sept. 7th, and to the hospitable manner in which the members present were entertained by Vice-President Leckie and staff of the Londonderry Iron Co. The special meeting was held at Montreal on Feb. 20th, on the occasion of the convention of the Mining Societies, when some 35 of our members were present.

Transactions—The Transactions for the year—Vol. I.—include Part I. (in press), on the formation of the Society and the petitions of lessees to the Governor-General of Canada and the Lieutenant-Governor of Nova Scotia, respecting certain legislation of the Parliament of Nova Scotia affecting mining.

Part II—Contains a report of the first meeting of the Society and papers read by the following gentlemen:—

E. Gilpin, Jr., LL.D., F.R.S.C., on "Notes on Nova Scotia Iron Ores."

H. S. Poole, A.R.S.M., F.G.S., on "The Introduction of New Explosives for Coal Getting in Nova Scotia."

J. S. McLennan, B.A., M.E., on "Changes in the Bank at the International Colliery."

J. E. Hardman, S.B., M.E., on "Recent Gold Milling Practice in Nova Scotia."

Part III—Contains a report of the second quarterly meeting held at Londonderry and papers read then.

R. G. Leckie, M.E., on "Roasting and Smelting Plant at Londonderry Iron Works."

R. G. E. Leckie, C.E., on "Iron Deposits of Torbrook."

Wm. Smaill, on "Notes from Laboratory on some Iron Ores from Nova Scotia."

Part IV is now in press and will contain a report of the December quarterly meeting and the special meeting held at Montreal in February.

Library—It is gratifying to the Council to be able to report that the nucleus of a library has been formed. The Society has some forty-five names on its exchange list, a considerable number of whom in return mail the Society their publications, and it is expected during the coming year that this number will be increased.

The Council would impress on members the desirability of collecting copies of all printed reports on mining properties in the province, even of those seemingly of no present value, with a view to keeping a record of the history and development of the industry. Where possible these might be supplemented by photographs of appliances and establishments.

Museum—The substantial collection of iron ores used to illustrate Mr. Smaill's paper read at the Londonderry meeting have been presented by him to the Society and are now on exhibition. It forms a valuable nucleus of what it is hoped will prove an attractive feature in the rooms of the Society, and the Council takes this opportunity to urge members to add to this collection by donating specimens of the various ores and minerals with which they have to do.

Quarters—Through the generosity of Mr. T. R. Gue, president of the Acadia Powder Company, a spacious room at 129 Hollis Street, in Halifax, has been fitted up and set apart for the use of the Society, and it seems fitting to the Council to here also record the obligations of the Society to Mr. Gue in this respect.

Treasurer's Statement—The Treasurer's statement is respectfully submitted herewith.

PRESIDENT'S ADDRESS.

MR. H. S. POOLE—When a year ago a general call to all engaged in mining in Nova Scotia brought together a goodly number of those interested both directly and indirectly, the most sanguine amongst us I cannot think anticipated the response that was then made and which it is my proud position to record to-day. The appeal touched a sympathetic chord in members of every branch of the profession, among quarrymen, among miners of gold, of coal and of iron, the moment was evidently opportune, and from adversity in the grasp of imposition sprang this Society into being.

It had been felt before, but in a vague and general way, that organization for a proper consideration and due advancement of interests common to all branches of mining in this province was desirable, but the feeling found only a divided expression in the formation of local associations and temporary gatherings that met to consider, and perhaps expose, actions of adverse tendency, so that when the matter in question was settled, the cause for unanimity being satisfied, the several elements, but temporarily united, again fell apart. Heretofore protests have been made by individuals sometimes alone, sometimes with others against immature or ill-advised mining legislation, with what effect may be gathered on turning over the pages of the Statute Book and noting the amendments that have been made, and the self-evident contradictions that have remained recorded and unrepealed for years. At times modifications have been obtained and then the seekers, after decisive enactments, have dropped back to their ordinary avocations and unorganized condition: contract being broken the moral weight of a combination was lost, not only for a time, but weakened also when the combination was renewed, since experience anticipated it would be but temporary.

The under current of general interest that led to these local and spasmodic gatherings however failed to find unanimous expression until the experience of the mining men of Quebec*, the formation of the General Mining Association of that province under somewhat similar circumstances and the success which attended their appeal to the public for a careful hearing of their grievances made patent to all in like case in Nova Scotia that in union they might with good management and a just cause hope to stem the tide of imposition, gain the public attention and show the partiality that singled out the mining industry for restrictive legislation and the imposition of requirements not otherwise imposed on other industries.

The spark that at last lit the beacon possibly was that which fell from the Premier of the Province when he remarked to certain deputations that presented to the Government their isolated views on some proposed legislation, why do you not decide among yourselves as do other industries and present your case as a united expression, then the Government will as far as possible meet your wishes. Perhaps it was this spark that caught the inflammable material in the loose sticks that hitherto individually had crossed each other and phantomlike from their ashes had bound them together into a bundle that it is hoped will long continue. At any rate when the call was made, the response was not halfhearted, the time was evidently ripe and lessees rallied to the watchword:—

"SANCTITY OF CONTRACT,
FIXITY OF TENURE AND
ACCURACY OF LOCATION."

Thus it was that the Mining Society of Nova Scotia took form and substance, and to-day we find ourselves organized with a membership numbering 75 and with representatives almost without exception of every company engaged in active operation.

Nor can it be overlooked how much this Society is indebted to its local forerunners the Coal Owners' Association of Cape

* *Canadian Mining Review*, July, 1891.

Breton and Pictou Counties, and above all to the Gold Miners' Association which during the four years preceding its amalgamation with this Society did so much for its members and by joint representation affected so many changes in that part of the chapter "Of Mines and Minerals" relating to gold mining, that of these matters they were fully justified in expressing satisfaction for the consideration received at the hands of the present administration. What the changes were that were effected I trust to see fully recorded in our Transactions. Already we see a new organization profiting by the experience the old lessees so rudely acquired last winter. The Whitney Syndicate which has since become the chartered Dominion Coal Company is indebted to this Society for making clear to them the desirability of having in their lease a right to appeal to the courts for settlement of disputes which may turn on the meaning of the wording in their leases. This has been acquired. What in substance the old lessees said last winter was:—Place us in the position of John Doe in dispute with Richard Doe over the legal meaning of our Indenture, let the courts decide and it will effectually stop all the talk about home and foreign capital having been misled into believing the sacred name of Her Majesty is used in the leases as typical of good faith, and the implications that the sanctity of contract has been violated when the *power* of the Legislature to convert "might" into "right" has been invoked, the Legislature being, as a landlord in the case in question an interested party. This right of going into court the old lessees have not as yet been granted.

Elsewhere I have drawn to your notice the incongruities which mark the legislation respecting the working and regulation of mines and their probable cause, by other of our members it is expected the remaining portions of the legislation included in both the chapters that deal with the leasing and working of mines will be reviewed. These matters of undoubted moment to our Society will, it is hoped, before long cease to be active questions, and then our individual attention can be given to reporting and discussing the many improvements and modifica-

tions which the rapid advances in the devices and arts place at the service of the miner. Our gold miners have no cause to fear competition in their business and do not object to share with others the benefits derived from changes in mining and milling practices; our coal members feel that when they have introduced an improvement in their pits they will not long be able to keep it hidden from their fellows and therefore that they may as well openly talk of it and get any credit there may be due for its introduction; while those of us who have met with disasters need not think our blunders or misfortunes will pass uncriticised because we ourselves say nothing about them, so we may as well make a virtue of necessity and point out if we can to others the way to avoid the pitfalls into which we have tumbled.

I would especially urge on members the advantage of having their papers for the quarterly meetings prepared well beforehand, and remind them there is a wide range of subjects and material open to them. Long papers are not necessarily asked for, concise statements of facts of which the writer is thoroughly conversant are preferred. The history of early mining practices in this country is of interest, while the more rapid developments of late years open fields that will extend as time rolls on and change succeeds change in methods of working, in facilities for production and transportation, and in substituting mechanical power for the more arduous manual labor.

ELECTION OF OFFICERS.

The officers for the ensuing year were elected as follows:—

President:

H. S. Poole, M.A., F.G.S., General Manager, Acadia Coal Co., Ltd., Stellarton, N.S.

1st Vice-President:

John E. Hardman, M.E., S.B., Manager Oldham Gold Company and West Waverley Gold Company, Oldham, N.S.

2nd Vice-President:

R. G. Leckie, General Manager Londonderry Iron Co., Ltd., Londonderry, N.S.

3rd Vice-President:

David McKeen, M.P., Resident Manager Dominion Coal Co., Ltd. Glace Bay, C.B.

Treasurer:

T. R. Gue, Halifax, N.S.

Hon. Secretary:

B. T. A. Bell, Editor, *Canadian Mining Review*, Ottawa.

Secretary:

H. M. Wylde, Halifax, N.S.

Council:

Charles Archibald, North Sydney, C.B.
R. H. Brown, Sydney Mines, C.B.
Chas. Fergie, M.E., Westville, N.S.
Graham Fraser, New Glasgow, N.S.
E. Sjostedt, Bridgeville, N.S.
D. W. Robb, Amherst, N.S.
B. C. Wilson, Waverley, N.S.
George W. Stuart, Truro, N.S.
Joseph H. Austen, Halifax, N.S.

The meeting then proceeded to consider the following papers

THE OCCURRENCE AND REDUCTION OF GOLD.

By Alfred Woodhouse, F.G.S., Mem. Inst. Mining and Metallurgy.

In this paper I propose to deal with points of interest that have struck me in the gold fields of India, Africa and Nova Scotia, and as my acquaintance with the latter is very short, I put forward my views with considerable diffidence, trusting that other members with far greater experience of this Province, will not hesitate to criticise and explain the errors I fall into, for in my opinion, it is the discussion and not the paper that educates.

The subject gold has a fascination for everyone and though termed the "root of all evil," is decidedly a blessing to civilization when properly employed. Gold is, I believe, the only metal for which a market is always ready, and it is the standard by which all products are valued.

Although gold occurs usually in very small quantities compared with other metals, it is probably one of the most widely distributed, as traces of gold are found almost everywhere, but not often in paying quantities.

Experience in different countries has shown that the profitable working of gold *does not necessarily follow* the existence of the metal in payable quantities, and I propose to point out in this paper some of the causes of failure.

Gold occurs in three forms as follows:—

1. In veins of quartz or other hard substances embedded in the matrix.

2. Associated with sulphurets of iron, copper, lead, etc., either chemically combined or otherwise.

3. In alluvial; that is in the detritus formed by the erosion of auriferous rocks due to action of weather, sun and atmosphere, by which particles of gold have been liberated, the lighter grains

of ground or powdered rock have been carried away, leaving the heavier mineral near the original source. I do not propose entertaining the disputed question of nuggets.

These three occurrences of gold are too extensive to be dealt with in one paper, and I will therefore confine myself to the first, or the occurrence in quartz and other hard silicious matrix.

Although one continually hears that gold occurs in some particular district, in quite a different way than in other countries, experience tends to show that, *practically the same laws of nature* govern all districts in different parts of the world, and I have found practical knowledge in any one country proves invaluable in new fields.

The miner, however, must expect to find *local characteristics* and probably no two districts have the same, but if parallel veins of quartz occurring in identically the same formation and lying only a few feet apart, differ so entirely not only in yield of gold, but actually in the nature of matrix, one may reasonably expect very great differences in two districts thousands of miles apart. To sum up I wish to convey the probability that gold occurs in veins of quartz in all countries, following certain laws of nature, affected by certain local characteristics, and that the difference in yield of two parallel veins in similar formation tends to show that our knowledge of the origin of gold is very limited.

A visitor to Nova Scotia hears a great deal about the anticlinal (or anticline) angulars, etc., but does the anticline affect the richness of the ore or do the veins nearest this point prove richer than those farther away? I think we must look further for a cause of rich streaks or deposits.

"Angulars" is a good local name for the numerous veins, strings or droppers of quartz that fall into and in some cases cross the true or formation veins or leads. These small angulars are not confined to Nova Scotia but are generally found in all countries under the name of feeders, which have leeched the country rock of mineral matter and fed them to the mother or formation veins.

All angulars, however, do not bring in a deposit of gold, and therefore certain angulars must have special advantages, if these are *really* the only source for introduction of gold, which theory I cannot agree with. Owing to the entire absence of a system of cross cutting in settled ground below, little is known of parallel veins except from surface indications, which are usually most deceptive, but I think it probable that many of these angulars are merely strings of quartz connecting two parallel veins. Angulars do not always terminate on contact with formation veins but pass through and continue on the opposite side, or they continue parallel with the vein for several feet and then cross over; in these cases they should, I think, be called "cross courses," and these cross courses *do* in my opinion play a very considerable part in the occurrence of gold. I have found by experience the nearer the cross course approaches to a parallel with the true vein the richer the deposit of mineral matter.

In the Montagu district the gold "chutes or streaks" usually occur from 200 to 250 feet apart and dip to the west at an angle of 43° to 45°, and the irregularity indicates that the "chutes" owe their origin to something more than angulars or cross courses.

If it is acknowledged that the precipitation of gold and metals is caused by certain laws of nature, and not by chance, we have reason to expect that the same laws have placed the gold in Nova Scotia mines that have occasioned the deposits in other countries.

The following will illustrate one theory of how gold may have been deposited in "chutes" or "streaks":—

All will admit that originally the formation of slate and quartzite was in a horizontal position, as it was deposited under water probably containing mineral matter in solution. Now it follows that this mineral matter would be precipitated provided certain foreign elements were introduced, say for instance, some vegetable matter.

No doubt everyone has seen the peculiar streaks or lines of seaweed on the ocean carried in comparatively parallel lines by

currents, the water between these lines of seaweed being entirely clear of foreign substance. Precipitation of mineral matter will be far greater on the line of seaweed or foreign substance than in the clear water. This illustration merely shows the possible theory of gold deposits in streaks by vegetable or other matter carried in parallel lines by currents over the newly deposited muds since converted into slates and quartzites.

Interesting as any theory of formation may be, I propose confining myself to the practical and profitable side of gold mining, that is following and extracting to the greatest advantage this valuable metal.

In commencing mining operations the engineer's first work is to very thoroughly inspect his ground, locating as far as possible his different leads and learning where gold has been found by former owners, making careful notes of past results. From his notes he will be able to make a rough plan and form some idea where gold may be expected below. With this knowledge he locates the position of his first attack, by adit if possible, if not by main shaft, selecting a position as convenient as possible to the mill site, which should be chosen well above the flat ground, so that no trouble will occur in the future from tailings. As the main workings and mill site form the centre of all future operations, too much care cannot be given to the selection of a place which offers the greatest facilities for permanent works. Managers often forget to look ahead to the future, when the mine requirements may assume very great proportions and instead of adding to the original works, a *fresh start* has to be made on a more suitable site.

The works should be laid out *originally* with a view to future contingencies, and the plan of operations carried out by degrees as funds will permit. Above all things the reckless cutting up of the surface by what are termed trial shafts should be avoided, as these become reservoirs to catch water and flood the future workings, necessitating afterwards costly pumping machinery, for once the mischievous work is done it can never be undone.

Having located the main shaft, the manager should decide to sink a certain depth, say 120 feet for his first level, and steadily continue to this depth, no matter what rich rock is met, the gold will not run away, and can be far more cheaply raised by overhand stoping from below, than from the system of burrowing or underhand stoping so common in the province.

I very strongly advise following the value of the rock passed through by saving "the drillings," the miners being supplied with marked tins for this purpose. It should be the foreman's business to see that these are delivered regularly to the manager who should pan them off and enter results in a book kept for that purpose. Many rich deposits have been found by this method when the gold was too finely distributed to be visible and would possibly otherwise have been overlooked.

As a rule the gold, or rather the payable portion of the lead, will be found to occur principally in chutes or streaks, the quartz rock between two streaks proving unpayable, and yet too often this unprofitable rock is taken out and crushed not only with a loss on the work, but also on the wear and tear of the machinery.

It is true every mine cannot maintain an assay department, but the manager can always follow his ore with the pan, and I am surprised to see the pan so seldom used in Nova Scotia, knowing from experience its great value as a guide.

The question of vertical or inclined shafts is one that is attracting attention; the inclined shaft, for prospecting work, has the advantage that the lead is tested as sunk upon, but any fault, slide or change in dip of the vein at once causes trouble, and with the numerous quartz leads found in most districts of Nova Scotia which must be cross cut afterwards. I consider vertical shafts the most desirable for permanent works, as it is only the one vein and that at one point which can be tested by the incline following the lead. When the vertical shaft has been sunk to a level it is easy to raise up or sink a winze on the vein in order that stoping can be commenced.

Working capital is provided to carry out the dead work which opens a mine, that is, sinking shaft and drifting on the

various leads, and further, when the mine is proved, to provide for the purchase and erection of the necessary machinery. When this has been accomplished, the cost of developing fresh ground to replace that extracted, should be added to cost of breaking and crushing a ton of ore.

With the shaft down to first level, the pan should prove the value of rock passed through, and the result should be carefully noted on the large working plan of the mine so that the position of the gold streaks on the next level may be fairly located. My experience has shown that once the rule of the occurrence of the gold is determined, nature is wonderfully true to herself, and unless from some fault or intrusion the gold will be found where looked for. If more careful attention was given to this matter much useless work need not be attempted.

In some mines of the province, notably Montagu, "nuggets" so called are found within the line of the streak or chute, and often contain from two hundred to three hundred ounces of gold in a few hundredweight of quartz. These nuggets occur with some regularity, 10 or 12 feet apart, and naturally greatly increase the yield, but as it has been the custom in the past to crush all ore throughout the mine, the average value of the rich chute has been much reduced by the addition of the unprofitable rock between the streaks, worth possibly only two or three dwts. per ton: and as there would be fully ten times as much of this poor rock crushed as of the streak ore, the rich ore has had to pay the loss on treating an increased tonnage, which must return a lower yield per ton throughout.

When the developments of Montagu enable the manager to attack only the streaks, leaving the poorer rock 'in situ' the returns should greatly exceed those made in the past, especially as by that time more of the occurrence of the gold will have been learned by experience under systematic workings.

The mines I have seen in the Province appear unusually free of water, except such as is derived from surface, where the numerous pits and cuttings form attractive reservoirs, and I have reason to think that if the shafts were puddled with clay well

tamped behind the lagging, very little water would be found below.

Considering the minute proportion of gold to the bulk of rock, too much care cannot be given to avoiding unnecessary handling of the ore, from which there must be loss in gold and increased expense. The rock as broken should fall into passes connecting with the level, whence a truck after being filled carries it to the shaft, and is hoisted to surface on the cage and delivered by tramway to the mill-house. When tipped, the ore is shot through a grizzly into the ore bins which supply the self-feeders, the large lumps which fail to pass through being put into the stonebreaker. By this method, handling of quartz is reduced to a minimum.

Too often the first object of a manager is to make a good show on the surface, and he starts erecting substantial works before he has learnt the value of the mine. This is surely putting the cart before tho horse, for surface works do not pay dividends, and it is far wiser to expend working capital first in development to prove what the mine contains, merely erecting such plant as is absolutely necessary for the requirements of development; before launching out into handsome buildings and expensive machinery, a system which has brought many a good mine into liquidation.

Ample working capital is most essential, and I do not consider Nova Scotia mines as a rule have had a fair chance in that respect. What would have been accomplished in other countries if they had had only the few hundred pounds that this Province has had? Failure would have been anticipated, and I consider very great credit is due to the mining men here that they have done so much with the small means at their command.

Again, owing to the fact that many of the mines have been opened by men having small capital, the profits have been distributed without building up a reserve fund for developing new ground when the rich ore they worked yielded smaller returns, and in consequence many mines that have yielded handsome profits in the past, are now closed down from want of funds to open

out rich ore lying below. With ample working capital mines can be worked not only on a larger scale, but by drawing ore from a dozen different points, the temporary falling off in yield at one or two places would not materially affect the return.

With the experience of the Indian mines, having a working capital of at least $100,000, and those of the Transvaal, where half a million dollars is far from an uncommon working capital for machinery and mine development, the small system of working in this Province cannot be considered a fair comparison, and yet I am convinced, from my own personal experience, that Nova Scotian mines will amply repay the outlay of large capital, provided it is judiciously expended, I mean in *bona fide* development, and not for show on surface.

The quartz occurs principally as bedded veins in a country formation of talcose or argillaceous slate, and dense quartzite tilted almost on edge, and the leads are likely to continue gold bearing to great depth, in fact, as deep as the slates. It is, however, probable that the sulphurets will increase as greater depth is reached. And as considerable gold is associated with these sulphurets of iron, copper, arsenic, lead and zinc, more attention should be given to their concentration and treatment, and generally they will be found a welcome asset.

The ore having been delivered at the mill the next process is to extract the gold as effectually as possible, and I would impress upon mining men that amalgamation is a science, and that it does not mean feeding so much rock under stampers with the addition of water to splash out the crushed particles, which are then conducted over some amalgamated copper plates. Any school boy or ignorant man can do that and catch a certain percentage of the gold.

The science of amalgamation is arresting and separating the last particle of gold that can profitably be extracted from the quartz rock, and I mean by this, that there is a point of gold saving, beyond which it costs more to extract the extra percentage than the value of the gold recovered.

The two first objects are to get the particles of crushed rock

out of the mortar box, when reduced sufficiently to pass the screens, without unnecessary pounding; and secondly to retain the gold in or as near the box as possible, and with this idea an amalgamated plate is generally placed inside the mortar box. On the crushed ore or pulp leaving the box, the great object is to check the forward flow of pulp as much as possible without causing it to silt, the tendency of a check being to precipitate any particles of gold either floating on the water or held in suspension, on to the amalgamated copper plate.

The advantages and disadvantages of introducing quicksilver into the mortar boxes, are much disputed, but I have found that with most ores it answers well, provided a copper plate is securely fixed at the back in a recess cast for the purpose, but in case of introduction, it should be used cautiously, otherwise it will be floured and splashed out on to the plates and a good deal will pass away into the tailings, as it is found floured quicksilver will not readily remain on the copper plate.

In case of grease and oil getting into the box with the quartz, it is advisable to introduce common caustic soda every few hours, as this dissolves the grease and keeps the inside sweet.

For ordinary quartz, I find a drop 8-9 inches, 80 to 85 times a minute most effective, and with coarse gold a steel wire screen with 1,000 holes per square inch. In some ores, however, the gold is so finely disseminated, that 2,000 holes is not too fine, but the capacity of the mill is naturally reduced with the smaller mesh.

In the Montagu mill the pulp as splashed through the screens falls on a plate 10 inches wide inclined towards the battery, with a pitch of 1 in 10 or 12, and is thus directed over a series of two ripples of quicksilver, with a third one below empty, so as to catch any quicksilver washed over, and thus protect the plate which should be 4 feet long with two ripples below, the upper one only being filled with quicksilver. From here the pulp passes over a second plate 4 feet long and then is conducted to the concentrator.

Although there are numerous patents for concentrators they are mostly very expensive, and often decidedly complicated, and I find the old fashioned straight throw Australian percussion table answers very well and has the great advantage of cheap construction by the mine carpenter.

This concentrator consists of a solidly built wooden table some eight feet long with two divisions. The first with a copper plate set at a low angle, say 45 degrees, eighteen inches long, from which with a rise of 1½ inches in 2 feet 6 inches is built the floor up which the ore must ascend. The lower half of the table is similar. This table is hung by four strong iron arms and is held firmly against a bumping block by a powerful spring. With a treble cam the table is pushed forward about one inch to be pressed back by the spring when free of cam, from 180 to 240 times a minute.

The jar naturally settles the heavy pyrites, the lighter sand passing off with the water. Any straying particles of gold or amalgam are caught on the copper plate, while floured quicksilver is again united by the continuous action. The machine is capable of taking five to seven tons every 24 hours. The concentrates are removed with a small shovel by the amalgamator when necessary.

A frequent loss of gold occurs from using too much water over the tables, there should only be just enough to make the black sand and pyrites drag along without actually silting.

Plates should be dressed every four hours, and at that time the battery and water should be stopped, as a piece of amalgam once moved is liable to be swept away with a rush of water. In dressing the plates, a very weak solution of cyanide of potassium may be used to remove any oxide of copper, but on no account should a plate be touched by the naked hand, a piece of chamois leather should always be used.

The quicksilver in the ripples should be retorted once a month, as retorted quicksilver has a greater affinity for the fine particles of gold than that which is charged, and the gold produced from retorting well repays the cost and trouble.

The use of sodium amalgam and cyanide is not to be encouraged, as both are very dangerous to the plates and quicksilver, unless thoroughly understood, but a very small piece of sodium amalgam, say the size of a pea, may be placed in each ripple once or twice a week to liven up the quicksilver.

Samples of tailings should be drawn every hour, water and all, and allowed to settle, and fire assays should determine the daily loss of gold per ton.

All details of mill work, such as stoppages, length and cause, time quicksilver introduced to mortars, speed of stamps, delivery of ore, etc., should be regularly entered in the mill book, which should be signed at end of shift by amalgamator. If these details are necessary, in an ordinary office, surely they should be attended to when a valuable mineral like gold is concerned.

It is not possible to enter into the question of the various chemical processes for treatment of concentrates in this paper, but I have found very effective results from simply grinding them to a fine slime, more especially if they have been spread out on floors, and exposed to the action of the sun and weather for several months. If a little salt is added, and the material kept constantly moist and turned over once a week, decomposition is rapidly effected and a very considerable proportion of the gold is liberated on treatment, and is rapidly amalgamated by quicksilver.

In grinding, I have found it advisable to add very little water for some time, so that the quicksilver may permeate the very thick mud in minute globules (which however are not in the form of floured mercury), and to assist the process, I usually add a little salt, caustic soda and cyanide, and after grinding for three or four hours a stream of water is turned on and carries off the slime to a percussion table, where pyrites not sufficiently ground are retained. The quicksilver remains in the grinding pan, which after the water is syphoned off is ready for a fresh charge of concentrates say, 5 or 10 cwt.

My object in dwelling on the concentrator and grinding process for treatment, lies in the fact that both can be carried

out on most of the mines in the province at low cost and are fairly effective, but should practical bulk treatment prove the sulphurets to have the value I believe they have it will then be time for the manager to look about for a more effective and modern process.

DISCUSSION

The President then called for discussion on the paper, printed copies of which the members had received previously.

MR. HARDMAN—I am going to say a few words about Mr. Woodhouse's paper. The main thing I wish to say is that he does not give us a chance to attack him. He has dealt largely with generalities in which we all agree. But there is one point in connection with the illustration given of "How gold may have been deposited in chutes or streaks," to which I may draw attention. I do not think Mr. Woodhouse has elaborated this illustration so much as he might have done.

The existence of gold in the sea water of the present time in amounts equivalent (according to Sonstadt), to nearly 1 grain, or 4 cents per ton justifies the assumption that the ancient sea-waters were equally auriferous and very possibly more so. From these mineral bearing waters the slates and quartzites in their deposition as muds or sands may have precipitated or taken down with them more or less gold. And I may say here that a rough calculation will show that the gold contained in the present oceans is sufficient to account for more than all the gold that has ever been extracted from the earth's crust so far as we have any records in history. If then we use Mr. Woodhouse's illustration of parallel lines of seaweed, or organic debris, we have a theory of the deposition of gold in streaks; assuming that organic matter has been a good and sufficient re-agent for the deposition of metallic gold from dilute solutions, the deposition will have

been greatest, as a matter of course, along the lines where this organic matter was accumulated.

Perhaps you are all familiar with the beautiful experiments of Mr. Chas. Wilkinson and Mr. Daintree of the Victorian Geological Survey, which have shown so conclusively the way in which gold can be precipitated in metallic form, even from very dilute solutions, by organic matter. In a paper written by Mr. Chas. Wilkinson in 1866, these experiments are given in detail, and he mentions an accidental experiment of Mr. Daintree's which led to the experiments undertaken later by himself. Mr. Daintree even in those early days, was an amateur photographer; on one occasion he had prepared for photographic use a solution of chloride of gold, the ordinary terchloride, leaving in it a small piece of metallic gold undissolved. Accidentally a piece of the cork, with which the bottle was stoppered, fell into the solution, decomposing it, and causing the gold to precipitate around the small piece of undissolved metal, increasing it to two or three times its original size. Previous to this, however, Dr. Selwyn, who at that time was director of the Victoria Geological Survey, had in one of his reports suggested as a possible reason for larger nuggets being found in the drifts or gravels than in the quartz reefs, that gold might have existed in solution in the mineral waters permeating the Silurian drifts or gold gravels of Victoria, and that this mineral water in so percolating might have been in some way decomposed and have precipitated its gold contents around the most congenial nuclei presented to it, which, electro-chemically speaking, would be the particles of reef gold already existing in the gravels.

Mr. Wilkinson, having knowledge of Mr. Daintree's accidental experiment, and of Dr. Selwyn's suggestion, was led to make some experiments. Briefly stated, the results were confirmatory, and established that metallic gold was easily and rapidly (in from three days to three weeks time), precipitated from dilute solutions of the chloride salt by the agency of organic matter, which, in order to imitate nature's processes as closely as possible, usually consisted of a chip of wood. In these experi-

ments Mr. Wilkinson used as nuclei particles of iron and copper pyrites, galena, zinc blende, antimony and other metallic minerals, and he found also that weak solutions gave better results than strong ones. But I am taking up too much time, and will say little more, except that to those interested in the matter the experiments of Newberry with mine timbers taken from Sandhurst, Ballarat and Scarsdale will prove instructive. In every case gold was found in the timber assayed. I might also refer to Dr. Holland's article in the "Geology of Vermont," and to the well known fact that sulphuretted hydrogen is evolved from the decomposition of marine vegetable matter. All I have said has been meant to follow out the idea in this paper of Mr. Woodhouse's, an idea which is well worth keeping in mind as bearing on the possible origin of "streaks and chutes." I think his illustration of the precipitation of gold along the lines of seaweed, formed by wave action is very apposite. I would like, however, to ask Mr. Woodhouse to define what he means by "formation veins," and also to give us his reasons for the statement made on page 7 of the printed copy of his paper that "*it is, however, probable that the sulphurets will increase as greater depth is reached.*" We are seekers after information, and any knowledge as to *why* we may expect an increase of gold or of sulphurets with increased depths will, I am sure, be very acceptable and pleasing to all of us who are mining for metals.

Mr. WOODHOUSE—I am very much obliged to Mr. Hardman for the criticisms and remarks he has made. Perhaps the paper is rather more general than it should be. By "formation veins" I mean veins running with the formation, what are called here "main" or "regular" lodes. In regard to the statement that gold may have been precipitated from seawater—while there is no doubt about one grain of gold being contained in every ton of seawater, yet it is a very vexed question how it may be thrown down from its solution. I have heard some professors on different occasions give their views, and very rarely have any two agreed. As regards the sulphurets being found in increased quantity at increased depths—the tendency would

be to get them below the water level at greater depths, because below the water level the deposit of metallic sulphurets is going on at the present time. I do not mean to convey in this paper the idea that sulphurets will persistently increase the farther down you go. At a certain point you will find a considerable change, which point varies in different mines, and is usually the water level.

MR. HARDMAN—May I ask what you have found to be the permanent water level in this country?

MR. WOODHOUSE—Say you go down a couple of hundred feet.

MR. HARDMAN—I have been down 500 feet and have not struck subterranean water.

CAPT. GEO. MACDUFF—As far as my experience has gone we have no water level in the gold fields here; it is all surface water that we contend with. I may mention that at our mines in Waverley we built dams in the 200 level which caught all our water, and it was surface water; below that level we only had two or three casks of water per day.

MR. HAYWARD—Leaving the question of water level and returning to Mr. Woodhouse's statement as to sulphurets, if the veins when found were in an approximately vertical position there might be something in Mr. Woodhouse's claim, but if in a horizontal position I fail to see it.

THE PRESIDENT—Some years ago I interested myself a little in the matter about the formation of our gold lodes, and the presence of gold in streaks and in so-called nuggets. I have got out of the business of late, and it comes to me like a very vague recollection. I have just turned up what I had written some years ago in reference to cross leads or cross courses, and their apparent effect on certain of the many formations, and I may just quote:* "Mining operations are not confined to the bedded leads, for rich streaks of paying quartz have been followed in cross leads and in what are called 'angling' leads. As a rule

*Report of the Dept. of Mines, N.S., for the year 1878, pp. 22-23.

cross leads of later age than the true leads are barren, or contain but a few pennyweights of gold. Their influence, or that rather of some so called cross leads, on the productiveness of a regular lead is often remarked on, but cross courses of later date are not always distinguished from contemporaneous connecting bands of quartz filling transverse fractures of the same age as the bedded leads. The effect of cross leads on the productiveness of regular leads is worthy of note. For instance, at the junction of a cross lead with the belt lead at Montagu, some rich spots gave as high as 40 ounces to the ton. Then in the discovery lead at Uniacke the quartz was found to be richer near the junction of what is there called a cross lead, but which in reality is an off-shoot from the lead into the hanging wall, the quartz of both being homogeneous. Whether the yield of the bedded leads is in reality influenced by the position of the cross leads may be doubted, and so of off-shoots, for in many leads the number is great and a rich streak has many chances of being near one. It does not appear, however, to be a rule that the dip of the streak and the off-shoot is in the same direction. No cross lead is known to shift a bedded lead, though faults and breaks are numerous."

These are some of the conclusions I came to.

Regarding the devisibility of gold and its universal dissemination, although we regard gold as one of the most stable of substances—it is interesting to note an incident at the mint in Philadelphia. After pulling off the roof of the old mint building it was sold for $4,000, and it realized to the purchaser a greater value.

Regarding the formation of gold or nuggets in gravel deposits, I have in my possession a small piece of gold about one-half an inch in diameter, from the lower carboniferous conglomerate of Gays River, which has a perfectly smooth surface with rounded edges, and it is water worn. It must have been formed prior to the conglomerate for on its flat surfaces rest groups of sharp edged particles; evidently they are subsequent attachments, *i.e.*, subsequent to the deposition of the conglomerate.

CAPT. MACDUFF—Speaking of "cross courses," the term does not seem to be understood here in Nova Scotia. In Australia we always find the richest gold near the disturbances. I have not, in my experience in Nova Scotia, met with a true cross course excepting the one at Waverley, in the workings of the Lake View Company, but that has not seemed to have effect upon the veins. I have, however, met many times with breaks, slides, slips, &c., shifting the vein for a few feet. Where you have a cross course it is usually filled up with broken foreign matter, and it heaves the vein many feet.

MR. REID—I would refer Capt. MacDuff to the lake lode at Caribou.

CAPT. MACDUFF—I have been there and examined the lode; that is not a cross course but a shift or heave of the lode.

MR. WILLIS—I may mention two cross courses met with at Rawden, one from two to fourteen feet in width filled with broken fragments of slate quartz and quartzite, which cuts the old Northup mine vein; and a second one 1,500 feet east and parallel with the first one. This second one is now being tested by the Central Rawden Co.

NOTES ON SOME SPECIAL FEATURES IN LODE FORMATION AND DEPOSITION OF GOLD, AS PRESENTED IN THE WAVERLEY GOLD DISTRICT, HALIFAX CO., NOVA SCOTIA.

By B. C. Wilson, Waverley, N.S.

I do not know that a knowledge of the origin of gold would be of any practical value or add anything to the sum of human happiness, but the method of its deposition and its geological associations are of economic importance as affording inferential authority as to the best means of extracting it from the place "where they find it," as Solomon expressed it.

This question when applied to Nova Scotia deposits is usually answered upon the generally accepted theory that most of our auriferous quartz veins, now found at all angles, from horizontal to vertical, were originally beds of silicious matter impregnated or charged with the constituents of the several minerals now found imbedded in them with intervening beds of slate or other rock, and built up in alternating layers much as the coal measures are, only differing in composition and presumably in age, and that apparently through the shrinking of the earth's mass and the forces of gravity calling on the outer crust to "close up" towards the centre, which crust, from its acquired rigidity, in consequence of exposure to external influences, could not follow in unbroken order it had to obey the inexorable mandate by reducing its surface area through a series of synclinal and anticlinal folds. Of the former, we, from obvious reasons, see fewer examples than of the more exposed anticlinal exhibits.

Every gold district has certain features in common with all the rest, and each has other features distinctively individual, which, if thoroughly studied out, afford authority for local development, and I purpose to give you some account of these

features generally and individually, as presented in the Waverley gold field.

This district is located twelve miles from the city of Halifax, and was among the very first half dozen discovered in the Province, and has the distinction of having had the very first licensed quartz mill in the country as appears on the records in the Mines Office at Halifax.

The auriferous veins of this district are on an anticlinal with an exposure of about two miles in a general east and west direction, conforming in this respect with the general trend of upheavals over the Province. A very pronounced fault or break occurs near the middle of the district locally causing the distinctions East and West Waverley, and crosses the strata or line of upheaval at nearly right angles, that is, north and south, forming the depression occupied by the chain of lakes and streams utilized years ago by the "Shubenacadie Canal." This fault is the most important one of the district, and so far it has not been possible to locate any vein found on one side as a continuation of any vein on the other. Another fault occurs on the west division which follows a surface depression along the line dividing areas 174 and 175, but the displacement is not important and the respective veins have been located on each side of it.

The anticlinal is most pronounced on the western division, the upheaval having been greatest there, and exposing more of the auriferous lodes, which stand nearly vertical in the middle of the district and assume gradually greater depression as they reach towards the western curvature. The extreme western exposure presents the continuation of the same veins round from the north dip to the southern dip, as notably exhibited in the workings on the Tudor vein between 1862 and 1869.

It is a noticeable feature of the district that while we have two western curvatures and dips of the veins, as yet we cannot place our hands on any indication of an eastern curvature or dip, nothing in fact to determine the termination of the lodes easterly.

The two western curvatures or depressions are represented: first, by the one on West Waverley, including such veins as Dominion, Tudor, Taylor, No. 6, &c., some of which have been traced to and into the canal lakes before referred to and under which the main fault occurs. Beyond this commence the lodes of East Waverley (east of the fault), and they too present a west curvature and dip towards the same lakes, and extend away east indefinitely, their eastern curvature and dip not being yet demonstrated, a piece of swampy ground operating against surface exploration.

I do not consider it at all proven that the two formations are identical, or rendered only apparently independent through influences of the great fault nor that they represent separate or independent anticlinals. This must be left for future developments to determine.

The ores of the district are recognized as free milling, with limited quantities of sulphurets, the gold being present in fine grains through the quartz, with occasional quantities of considerable value, as instanced in a lot of about 500 ounces taken from about 1,000 pounds of quartz from the Barrel lode on East Waverley in 1862.

The Taylor and Tudor lodes were early representative lodes on the west division of the district. The first gold found on the Taylor was a nugget of 6 to 8 ounces, the ore being quartz with but very little associated minerals. The Tudor was an exceptionally well defined vein from 10 to 30 inches thick with smooth walls, and though no large nuggets were found, small ones from 5 to 20 dwt. were frequent. This lode was for a long time the chief gold producer of the district, the monthly brick from it at times being from 1,000 to 1,200 ounces.

Formerly no account was taken of the sulphurets in the ore nor of the gold they carried, but latterly more attention has been directed towards them. By far the greater proportion of sulphurets in the Waverley ores is arsenical iron, of which one distinctive feature is noticeable (and I am not aware whether it prevails in other districts or not), which is, that where the arsen

ical iron is imbedded in the body of the quartz it is usually rich in gold, but where it is situated as a slab or deposit on one side of a lode that it is mixed up with the slate and quartz on one side of the vein only, it rarely carries much gold, assaying but from 10 to 25 dollars per ton of concentrates.

Some thirty years ago a vein two or three inches thick was opened near the centre of the district on West Waverley, which was practically solid arsenical iron, but as it showed little or no visible gold it was ignored, for no one at that time thought of an assay test. Also about the same time a vein 4 to 6 inches thick was opened on the extreme western curvature which was probably 75 to 90 per cent. sulphurets, chiefly arsenical iron but associated with copper, and though presenting but very little free gold yielded under the stamps from 10 to 21 dwts. per ton, but the vein being narrow and the density of the ore making it objectionable for crushing, it was not worked beyond a few tons and no assay test of its value was ever made, but from my recollections of it I have every confidence it was a valuable ore, and if it maintains its size will yet pay to work.

The Barrel lode on East Waverley carries arsenical iron distributed in small quantities through the quartz and frequently in pockets from a pound to a hundred pounds, and occasionally in lots of a ton or thereabouts, quite crowding out the quartz or more properly taking the place of the quartz in the vein, and such deposits were invariably rich in gold, but at the time they were worked, twenty-five to thirty years ago, their value was not recognized, but I have knowledge of a lot of four or five tons collected by natural concentration as it ran from the mill and taken up after a year's exposure to the elements and put through the stamps again which yielded 63 dwts. of gold for the lot.

The workings on the western division have reached nearly 400 feet in depth, and have developed no special feature beyond a well defined formation, the veins on both the north and south dips maintaining their full strength and showing no signs of extinction.

One important feature demonstrated in this district is that

comparatively no flow of water worth mentioning has been found in the deep workings. What has to be contended with is from surface sources largely increased in the old workings by the ill-advised methods of mining twenty-five years ago, where the drainage has been *into* instead of *from* the mines, but this can be avoided in the future by making new openings and operating under the old works which in general have no considerable depth.

During the first fourteen years that the Waverley mines were operated some 51,000 ounces of gold were reported at the mines office, fully eight-tenths of which were obtained from West Waverley, since which time until the last two or three years all mining there was relegated to the spasmodic and destructive operations of tributers.

The ore on the east division though discovered simultaneously with that on the west, and at that time considered the richest in gold, was supposed to be circumscribed in area, and local conditions prevented any extensive operations. Yet it is on this east division where the most interesting geological problems are presented, and where glacial and pre-glacial forces have left their unmistakable imprint.

The ground to the west of the main fault before referred to extends away in low hillocks seldom reaching over 90 feet above the level of the lakes.

On the east side the exposed rock rises abruptly from the lake in a strong mountain range, backed by an extended tableland and attaining an altitude of about 200 feet in places, and this heavy deposit of metamorphic rock appears to have been an occupant in possession long anterior to the anticlinal upheaval, which brought the auriferous lodes of the Waverley district to the surface, and further, this backbone of table rock appears to have presented decided objections to being disturbed by the ambitious new comer, and if the two powers of the period exchanged any courtesies they were probably akin to those between the ant and the elephant, "Who are you shoving," at any rate there are evidences of some very decided "shoving" on the part

of the latest arrival, and some equally obstinate resistance by the original "party in possession," and so vigorous was this conflict that the old mountain carries very conspicuous marks of it on its back, and had grudgingly to afford room for the obtrusive metalliferous series, but still held its own so well that there are no scars on its western brow, and it had such a firm foothold under the waters of the lake below that there are no signs of his having "budged an inch."

In 1862 some drift quartz carrying gold was found on the top of this hill, and further search revealed the outcrop of a sheet of quartz lying nearly horizontal, covered with two to four feet of soil and a corresponding amount of rock, and continued workings disclosed what might aptly be termed a blanket of quartz overlying the hill and gradually dipping south, west and north, but most decidedly to the west, or towards the lake at the foot of the hill, and several small owners soon made numerous openings on it, each apparently intent on forming open reservoirs for the local water-shed and in which they were exceptionally successful, and discounting the future for immediate results, soon got it in such condition that no one could work it, notwithstanding the ore at one time was very remunerative; and eventually all work ceased except an occasional effort of some tributor, who managed to find some spot of ore on high ground. But practically everything was under water, and it became generally conceded that the only economic means of operating it would be through a tunnel driven from the lake level and intercepting the vein at about 200 to 250 feet below the surface openings and thus escape the overwhelming water of the surface. The scheme though a good one was confronted with the necessity of providing many thousand dollars to carry it out, also a further deterrent was the frequently expressed doubt of the vein existing at that depth and in such position as to be reached as proposed. But after a lapse of many years such a tunnel was eventually driven some 635 feet, and last December struck the vein on the back or crown of the anticlinal on its western dip toward and presumably

under the lake where as before mentioned the old mountain has such a firm foothold.

The developments from both tunnel and surface workings are most interesting to the geologist as well as to the miner, a very interesting feature being the peculiar forms presented by the auriferous veins.

At the outcrop it was crimped or folded together upon itself and if smoothed out like a sheet of paper would have presented a vein not over 10 to 12 inches thick, but being folded together it filled a space of 20 to 30 inches, and with associated slate occupied a working belt of about 48 inches between the upper and lower enclosing walls of hard metamorphic rock, and when denuded of the overlying rock presented the appearance of rows of barrels, and hence the name "Barrel Lode" was applied.

There was originally much speculation as to what would be the form of the vein at the tunnel level. Some thought it possible that it would be smoothed out, that is, divested of its crimpings, which were presumed to be the result of surface shrinkage or compression. On the contrary the foldings as demonstrated in the tunnel workings are in no way changed beyond being apparently compacted by the increased weight of the superincumbent rock.

Whatever may have been the difference in age or time of deposition of the several strata and auriferous veins the condition in which we find the quartz may be accepted as presumptive evidence that at the time of upheaval, the material composing the several belts must have been in different states of rigidity as the quartzite under the Barrel lode shows only occasional change of form, consequently must have been quite rigid, while the overlying rock was most pliable and conformed in some measure to the forces exerted upon it, but the auriferous belt, particularly the quartz part of it (and now the most rigid of all), and which plainly shows the marks of laminated deposition, must have been the most plastic of the lot, to admit of its carrying all its laminations unbroken through all its various bendings and curvatures, and there are instances where the quartz is found forced into

wedge-shaped cracks or cavities in the rock ending in rounded edges and leaving an unfilled space at the extreme end of the split, much the form that soft putty would assume if pressed into a similar cavity, and apparently demonstrating that the infilling material was not silicious waters eventually solidified as in the case of fissure veins.

So far as present workings demonstrate, at the lower or tunnel level, which I estimate will vary at different points from 250 to 500 feet below the surface openings (not in perpendicular height, but on the dip of the vein), there is nothing to warrant the belief that the character or value of the ore is in any degree changed or that it is richer or poorer than was the 6,000 tons (or thereabouts) mined at the outcrop, nothing in fact to throw any light upon the probabilities of deep mining in the Province beyond what we already know.

The ore is identical in color, markings and associated minerals, and the gold is deposited in the matrix with the same idiosyncracy which characterized it at the surface, and so far as can be predicted, short of milling test, in about the same relative proportions.

Reviewing the foregoing from an economic or miner's standpoint, I may observe that the conformation of our Province affords but few places where this method of reaching the ore through a tunnel giving drainage and exit for ore without pumping or hoisting will apply.

The rock throughout the gold series of Nova Scotia is generally compact, and after the first fifty or seventy-five feet there is very little "coming" or bottom water to contend with. The greatest trouble being from surface sources, aggravated by the pernicious system of mining heretofore pursued, and perpetuated in many cases to the present day, of artificially carrying the natural drainage into instead of away from the mine, and ensuring to the persevering miner a supply of water sufficient to keep him poor and busy all his lifetime in keeping it out. If, however, the surface accumulations from whatever cause or source can be gathered and carried off by gravity, then further

and deeper workings, though below Atlantic or other drainage level, can be conducted with such an immunity from this indispensable element in the wrong place, that it becomes a consideration if it is not economy to incur the initial outlay for drainage large though it be, where conditions make it practicable.

Returning to geological considerations again. There was one interesting feature presented on the Barrel lode which it has never been my privilege to witness elsewhere, viz: glacial markings on quartz.

When in the surface workings, the soil was removed from the rock overlying the quartz at or near the outcrop, the striae or glacial footprints were such as to rejoice the heart of an enthusiastic geologist, and in fact many are yet visible on portions of the undisturbed rock. In one spot where the auriferous vein protruded through its metamorphic covering a strip of quartz probably 25 feet long by 8 or 10 feet wide had been exposed to glacial scouring, the inequalities worn down, and the quartz polished like a piece of ivory, and eroded creases half an inch deep, cut into the retaining rock on either side, were continued straight on across this polished quartz showing the continuous striae or track of nature's great planing mill.

The fact of the quartz being so doubled up with the slate within the walls of the working belt, and that the underlying quartzite shows hardly any evidence of lateral compression, and the overlying only to a limited extent and only in the vicinity of a contact with the quartz, we are led to enquire what was the relative consistency of the several masses and whence came the apparent excess of vein matter to admit of so much folding. It would seem as if the piston of some mighty cosmic engine had been exerting special pressure upon the auriferous belt from some unknown distance, utilizing the upper and lower walls as a cylinder, and if so one might expect to find evidence of a movement of the material composing the working belt (slate and quartz), within the limits of its " foot " and " hanging walls," and this is just what we do find evidence of in the polished state of the relative surfaces as though there had been a sliding of the

auriferous belt within the stationary retaining walls.

Now whether this was just what did occur I am unable to state, I am merely giving you the facts as we find them illustrated in the workings, and if we accept the inference as stated it would seem to demand that the auriferous vein as originally deposited must have occupied less space than now, say about 12 inches of quartz and 12 inches of slate—laying out smooth—not crimped, and contemporaneously with the upheaval, lateral pressure was exerted on the vein matter which forced the upper and lower retaining walls apart, permitting the quartz and slate to fold up and occupy about four feet between foot and hanging walls, but just how the great natural engine applied its force or whence it got the extra supply of auriferous vein matter are questions to which I offer no solution.

THE PRESIDENT—The second paragraph of Mr. Wilson's paper attracts my attention. I will only take one point. The good that a man does is always accepted—it is only his weaknesses that we want to discuss, and therefore if I hold a view differing from Mr. Wilson it does not follow that I am objecting to the rest of the paper. The drawings which Mr. Wilson has prepared showing the actual position of these barrels is an interesting sketch. Mr. Wilson says:—

"This question when applied to Nova Scotia deposits is usually answered upon the generally accepted theory that most of our auriferous quartz veins, now found at all angles from horizontal to vertical, were originally beds of silicious matter impregnated or charged with the constituents of the several minerals now found imbedded in them with intervening beds of slate or other rock, and built up in alternating layers much as the coal measures are, only differing in composition and presumably in age."

I think I know something about coal measures. The auriferous quartz veins or lodes were not deposited in the same way. Mr. Wilson has a very good authority for the views which he takes. Dr. Hunt, whose chemical geology is a standard work even to-day, visited the Province about the year 1870 and wrote

a report. I ventured in 1878 to take issue with him upon the conclusions which he drew and then I wrote as follows:—*

"The distinctive features of the gold leads of Nova Scotia are their general conformability with the slate and quartzite beds and their regularity, suggesting that they are rather beds than veins. But there are characters that point to their being true veins in spite of these features, and they are the following: The roughness of the planes of contact between quartz, slate and quartzite: the crushed state of the slate or gangue on some foot-walls: the irregularity of their mineral contents; the terminations of the leads: the effects of contemporary dislocations: and the influence of stringers and off-shoots on the richness of the leads, characters that singly or collectively it would be difficult to account for, associated with a stratified deposit."

I venture to think that my opportunities of going under ground which I had enjoyed some years before were greater than Dr. Hunt's, and having this statement in view I was continually looking at the face of the slopes to see if his conclusions were justified by the appearance of the quartzites, etc., and I came to the reverse conclusion. I saw nothing there that would lead me to believe that they were truly bedded deposits. The quartz in all cases appeared to me to be of subsequent deposition. That it contained fragments of slate lying in all conceivable positions in relation to the beds of quartzite—that fragments tailed off from the lead that appeared falling out and held partially away from the walls—just as you find them in drift veins which cross the regular leads contrary to the bedding. The only thing that made me at all doubtful was the invariable appearance of these leads lying between beds of slate and quartzite. If you carefully observed you would see that the lode did vary in a bed of slate sometimes from one side to the other. Between two beds of quartzite which govern the character of the formation, you had always slate on one side and partially on the other. I came to the conclusion that it was quartz which had been subsequently deposited. Of course these cracks occurred from the folding of

*Report of Dept. of Mines, N.S., for the year 1878, p. 27.

the strata in the regular form which we now have it, and that is a point. Mr. Faribault has been mapping these veins with a great deal of care showing the whole series from one end of the Province to the other. His report will be to the effect that the folding is due to subsequent pressure and that the pressure that has been brought to bear by lateral pressure was caused by the continuous accumulation of depositions in deep seas which lie against or along the straight edge of older rocks—such as has since formed the range of the Appelachian chain which extended in this direction. I think this question is an interesting one and one open to great elaboration.

MR. HARDMAN—I also wish to differ from Mr. Wilson in respect to his view that our gold veins were once horizontal beds, contemporaneous with the slate and quartzite. Mr. Wilson makes one or two statements rather in the line of questions, inviting comparison with other districts—one is in relation to the value of the sulphurets when found in different positions in the vein-stone. He says, "he is not aware whether it prevails in other districts or not, that where the arsenical iron is imbedded in the body of the quartz it is usually rich in gold, but that where it is situated as a slab or deposit one side of a lode (that is mixed up with the slate and quartz on one side of the vein only), it rarely carries much gold." Our experience at Oldham, in where the sulphurets occur on one side—the hanging wall side—is that they will average value $75 to the ton; where they occur in the middle of the vein the assay yields $12 to the ton. In the Dominion lode I am working at Waverley, I find a great divergence in the sulphurets, whether taken from the middle or side of the vein. One or two samples that have been taken from the foot wall side of the vein have shown values approaching $30, which is more than treble the value of those samples taken from the middle of the vein. At Isaac's Harbor, on the Victoria lode, I noted also that the sulphurets nearest the slate wall were richer than those in the body of the vein. I may say that the slate in Oldham is on the hanging wall of the lode, and the sulphurets that are rich lie next the slate

As to another point, Mr. Wilson does not consider the two formations of Waverley identical—*i.e.*, East Waverley and West Waverley. I would like to ask him whether he means to say that East and West Waverley were not contemporaneous—that they were not produced simultaneously by the same pressure which produced the anticlinal.? If he does then he differs from Professor Hind. It seems to me also that he is going back of the record of the different lodes. I cannot avoid the conclusion that they were both contemporaneous. He also says that the fault on the western side is not important. From a mercenary point of view I am extremely interested in this fault, and think it the most important of them all.

Mr. WILSON—In reference to that fault, Mr. Hardman refers, I suppose, to the fault between areas No. 174 and No. 175, which I believe is somewhere about 118 feet in extent. I look upon that as not a shifting of the material of the ground north and south, but I look upon it as a direct movement up and down of the material composing the rock on what is called the "American Hill," and you will understand if a vein or portion of ground lying at that angle is broken off, and lifted square up, that the other vein down here will be represented over here a number of feet to the north, on account of that dip being to the north. I have always considered that the fault referred to was not a lateral break of the ground, by which a portion of the ground was carried north or south, but rather a direct raising up of the material forming "American Hill."

Mr. HARDMAN—In order to be a direct raising up the angle of that fault plane would have to be a ninety degree dip. The dip of that fault is to the eastward, therefore it could not have been a direct lifting up—there must have been a sliding action.

Mr. WILSON—We must take a great deal of our geology upon faith. I find a great many questions arising in the Waverley formation which are quite enigmas to me, and I cannot see that anybody else has been able to explain them. Our worthy president's father did undertake to explain to me the origin of

the quartz at Laidlaw's Hill, but I do not know that his statements have been borne out by developments afterwards, nor that they have been very far astray either. There are certain points we have not got around yet, and I have been careful not to advance any of these as my own theory, nor would I back them up, still in the absence of anything better, I will have to adopt them. I made the statements regarding sulphurets on my experience. I always considered where gold showed in the sulphurets, those sulphurets were richer than those which showed no gold. Sulphurets which are associated with gold in the quartz are invariably pretty rich.

MR. HARDMAN—I sent some nodules of arsenical pyrites to be assayed which were in the midst of white quartz, and which carried large gold particles, yet they gave only six pennyweights to the ton of arsenical iron.

MR. HAYWARD—Was that from the Dominion lode?

MR. HARDMAN—Yes.

MR. HAYWARD—As to East and West Waverley, and referring to the breaks, it has always been my opinion that American Hill has been shifted to the north 118 feet, and also that it has been raised up 80 feet, from its original position. In forming these conclusions I found the formation of the rock east of the break, as it was broken, tailed to the south and that the fault was traceable through the valley.

MR. STUART—I have nothing to say with regard to Waverley, Mr. President, but I agree with your own remarks and Mr. Hardman's in regard to this auriferous formation not carrying bedded leads. Every day I see evidence of that negative fact; and there is no stronger evidence that I have ever seen than the lake lead at Caribou, which is in a bed of talcose slate. This section I have made (and will hand around), represents 150 feet in length of the lode, and if you will notice where the lode crosses the strata you will find it is much richer than where it runs parallel with the strata. I am now speaking of the lake

lode vein proper. Where the rich quartz occurred in the lake lode mine, running back across the strata, there were no feeders.

Where we got the very rich quartz which I took out last December on the Truro Company's property, there were feeders, that is, the rich quartz was in one of those side leads which divide the vein. I cannot see how it is possible that our auriferous leads in Nova Scotia have ever been formed in any other position than that in which they are found to-day.

ANNUAL DINNER

In the evening the Society held its annual dinner at the Halifax hotel. The *menu* did credit to host Hesslein, and was thoroughly discussed by the large number of members and guests in attendance. Mr. H. S. Poole, of Stellarton, the president, occupied the chair, and on his right and left respectively were Hon. Premier Fielding and Hon. Attorney-General Longley. Mr. J. E. Hardman, of Oldham, occupied the vice-chair. The first toast was "The Queen," proposed by the chairman. This was followed by "The Sanctity of Contracts," which was given with a ritual and highly enjoyed. Mr. Hardman proposed "The Government of Nova Scotia," to which Hon. Mr. Fielding responded. "Politics and Mining as a Fine Art," proposed by Mr. Poole, was responded to by Hon. Mr. Longley. Mr. Drysdale responded to "The Legal Fraternity," and Messrs. Harrington and Dickman to "Our Guests." Various other toasts were honored, and among the speakers were Mr. T. R. Gue and Dr. McKay, of Truro. Songs were indulged in and everything passed off in a very pleasant manner.

TRANSACTIONS

OF

The Mining Society of Nova Scotia.

The Society as a body is not responsible for the opinions and views expressed in the several papers presented with the Transactions.

VOL. II. SESSION 1893-94. PART II.

The summer meeting of the Society opened at New Glasgow on Thursday, 29th June, when an enjoyable excursion was held at the new iron works at Bridgeville and Ferrona, operated by the Pictou Charcoal Iron Co. (Ltd.), and the New Glasgow Iron, Coal and Railway Co. (Ltd.) An excellent luncheon, given by the New Glasgow Iron, Coal and Railway Co. (Ltd.), was served in the New Cast house of the Pictou Charcoal Iron Co. (Ltd.), at noon. There were present: Mr. John F. Stairs, M.P., Halifax, (President New Glasgow Iron, Coal and Railway Co.); Mr. D. C. Fraser, M.P., New Glasgow; Hon. J. W. Longley, Halifax; Hon. A. C. Bell, New Glasgow; Mayor Jennison, of New Glasgow; Dr. E. Gilpin, Jr., Deputy Commissioner and Inspector of Mines, Halifax; H. S. Poole (Acadia Coal Co.), Stellarton; John E. Hardman (Oldham Gold Co.), Oldham; T. R. Gue (Acadia Powder Co.), Halifax; James Baird (Canada Coal and Railway Co.), Maccan; R. G. Leckie (Londonderry Iron Co.), Londonderry; C. Fergie (Intercolonial Coal Co.), Westville; J. G. Rutherford, Jr., (Acadia Coal Co.), Stellarton; B. C. Wilson, Waverley; George W. Stuart (Truro Gold Co.), Truro; Duncan McDonald (Truro Foundry and Machine Co.), Truro; Wm. Smaill (Londonderry Iron Co.), Londonderry; E. A. Sjosjtedt (Pictou Charcoal Iron Co.), Pictou; G. F. Moncton, Sherbrooke; Simon A. Fraser, New Glasgow; Jas. A. Fraser, New Glasgow; J. D. MacGregor, M.P.P.,

New Glasgow; M. Fitzpatrick, New Glasgow; H. M. Wylde, Halifax, *Secretary*, and B. T. A. Bell (*Canadian Mining Review*), Ottawa.

Mr. John F. Stairs, President of the New Glasgow Iron, Coal and Railway Company, presided.

The usual loyal and patriotic toasts having been honored,

HON. J. W. LONGLEY, in responding to the toast of "The Government of Nova Scotia," said: He was glad to have this opportunity of personally inspecting the iron industries of this section of the country. A person making a dismal effort to maintain a conversation with an old maid, after a deathly pause enquired as a starter, "Did you ever see Niagara Falls?" Whereupon she drew herself up primly and replied, "No, I have never seen them, but I have heard them highly spoken of." He had never seen the works at Ferrona and Bridgeville, but he had heard them highly spoken of, and he thought it his duty to be present. The chairman had placed him in rather an embarrassing position. He had referred to him as an after dinner speaker, and that too when the usual conditions were absent—this being a Scott Act county. (Laughter.) Such an occasion would doubtless call forth the eloquence of his friend Mr. MacGregor, who had been more used to this kind of diet. (Laughter.) The Government of Nova Scotia had rendered some assistance to the iron industry by the construction of the railway over which they had passed to-day. It had done so not in any sense as a favor to the company, but simply because the work of the development of our great iron resources was one which demanded prominent recognition, and in the name of the people and the Government of Nova Scotia, he desired to express entire satisfaction with the great progress that had been made. When any work or enterprise of this character is undertaken in any portion of this Province the Government was free to give to others the same measure of assistance that had been granted to this company. Nova Scotia was a small province, but within its borders were the possibilities of a great industrial and mineral development. With

coal and iron and fluxes in abundance side by side, gold in paying quantities, and a large variety of other economic minerals, the possibilities of the future of the province were great. The time had come when the people of the Province should realize a sense of the great obligation that is cast upon them to develop these resources. Nova Scotia should be made the centre of the greatest mining and manufacturing industries of this continent. He concluded by asking them to drink success to the New Glasgow Iron, Coal and Railway Company.

Mr. Graham Fraser and Mayor Jennison briefly acknowledged the toast.

THE CHAIRMAN, in proposing the Mining Society of Nova Scotia, referred to the beneficial effect the organization had in fostering and developing the mineral wealth of the Province. It had, he said, a tendency to encourage investors in mines and capitalists to embark in the various mining enterprises of the province.

MR. H. S. POOLE—The organization which I have the honor to represent is a young one. It is on trial. It has come into the County of Pictou to ask for your suffrages and your consideration. We have been in existence over a year, and have made good progress. I feel assured that the Society is recognized as a possible unit of some weight. He thanked them in the name of the Society for the very hospitable reception that had been tendered them, and for the hearty manner in which the company had responded to the toast.

HON. A. C. BELL referred to the growth of the mining industry in Pictou County. It was pleasing to the citizens of New Glasgow, he said, to see some realization of what had been in their early days, dreams exceedingly vague of what the county might some day become. In his early days the people were accustomed to compare New Glasgow on the East River with its namesake on the Clyde. A few years ago where the steel works now stand there was nothing but green trees. The coal trade had grown. The building of iron vessels was now one of the

industries of New Glasgow. In conclusion he eulogised his old school fellow Mr. Graham Fraser, who by his courage and ability had done so much to promote the establishment of the iron industry in the county.

The toast of "The Ladies" was responded to by the Hon. J. W. Longley.

MR. H. S. POOLE in a few well chosen words referred to the work done by the Pictou Charcoal Iron Company, and proposed a vote of thanks to the company for the use of their buildings on the occasion, and for the invitation to inspect their mines and works.

Mr. E. Sjosjtedt briefly acknowledged, and the proceedings terminated.

Luncheon over, the members, escorted by the officers of the Company, visited the mines, kilns and furnace plant owned by the Pictou Charcoal Iron Co. (Ltd.), a full description of which will be found by referring to the paper read before the Society by Mr. E. A. Sjosjtedt, the Manager, and published in Part IV., Vol. I., of the Transactions. Thereafter the party took train and enjoyed a run over the line of railway to Sunnybrae, operated by the New Glasgow Iron, Coal and Railway Co. (Ltd.) A brief stop was made at the limestone quarry. Then, returning to Ferrona, the remainder of the afternoon was spent in visiting the iron mines, coal washing and coking plants, furnaces and other works operated by the New Glasgow Iron, Coal and Railway Co. As these works are fully described in the paper by Mr. Walter Stein in this volume, it will be unnecessary to say more than that the members were greatly pleased with the works, and each and all returned to New Glasgow with a keen appreciation of an enjoyable and instructive outing and the courtesies extended to them by the officers and staff of both companies.

RECEPTION IN NEW GLASGOW.

In the evening the members gathered in Bell's Hall, New Glasgow, where by invitation of the local committee a goodly company of ladies and gentlemen from New Glasgow and neighborhood had assembled to meet them. The platform was tastefully decorated with plants, while the walls were hung with various maps, plans and drawings. Among these were noticed the original plans and profile of the Albion Mines Railway, made by Peter Crerar in 1834, together with his designs for bridges, culverts, etc; also a large scale map of the Picton coal field prepared by the Geological Survey of Canada in 1869, together with another made from investigations by Mr. H. S. Poole, M.A., F.G.S., and other members of the staff of the Acadia Coal Company, showing many changes and corrections in geological data presented in the old Survey map. An interesting display of safety lamps, gas testing apparatus and other mining exhibits claimed attention. These were in charge of Mr. J. Geo. Rutherford, Assistant Manager of the Acadia Coal Company, and a staff of assistants, and included:—

I. Biram's Anemometer in use 40 years ago.

II. and III. Biram's Anemometer in use at present time, and Davis' Patent Self-timing Anemometer.

IV. Liveing's Patent Gas Indicator for detecting small percentages of fire damp by means of electricity.

V. An old compass used for surveying the mines many years ago.

VI. A 7-16 in. chain which had sustained a weight of 6 tons 7 cwt. without breaking.

VII. A ½ in. wrought tube rent by an ordinary detonator exploded inside.

VIII. Samples of the various wire ropes, ordinary rope, Lang's lay and Elliot's patent locked coil.

IX. The apparatus for use in deleterious gases, consisted of a smoke absorbent. B. Loeb's patent breathing arrangement, and the Fleuss breathing dress, consisting of a steel cylinder into which oxygen is compressed up to 260 lbs. per sq. in., affording a supply sufficient for four hours. Over the cylinder is a filter divided into four compartments and filled with alternate layers of tow and caustic soda. The exhaled air passes through this filter, the carbonic acid gas is absorbed by the caustic soda (the tow being present simply for dividing the air), and the residue passes into a bag of about 40 cubic inches capacity placed on the chest, and is here replenished with fresh oxygen from the cylinder as occasion may require.

X. An ambulance and basket of appliances in cases of accidents.

XI. The lamps were Davy, Stephenson and Clanny, all invented about 1816-18; all the modern lamps, Mueseler, Bonneted Clanny, Marsaut-Ashworth's patent Hepplewhite Gray Deputy's lamp; Pieler lamp, which burns alcohol and detects one-fourth of 1 per cent. of fire damp; Thorneburry lamp, burning a mineral oil of high flashing point, and providing a light equal to from 1 to 1½ candles, whereas the Davy gave a light of one-fifth of a candle, and lastly, portable electric lamps both primary and secondary.

XII. A small portable low-tension exploder for firing shots in the mine.

XIII. A patent multiple wedge for bringing down coal.

XIV. A patent self-lubricator for box wheels.

On motion of Mr. H. S. Poole, the Hon. A. C. Bell was moved into the chair.

HON. A. C. BELL said: Ladies and gentlemen, I congratulate myself on being honored in presiding over a meeting of citizens of New Glasgow, whose privilege it is to welcome to our town the Mining Society of Nova Scotia. I congratulate the citizens on the happy occasion of this meeting. They are honored by having as their guests the members of this Society, and in re-

ceiving men who have gained eminence in all departments of the mining activities of the Province.

To-night we welcome those who have taught us how to extract the all powerful yellow metal from that portion of our Province which seems to offer least for the benefit of man, and to be of almost no value to the country. Gold is powerful, but more powerful is wealth of iron and coal, and to-night we have the honor of receiving as our guests the men who have achieved success and acquired distinction in the large operations of our collieries and iron works.

Our Province owes much of its wealth and much of its position in the Dominion and in the world to the labor of the mining engineer, and we may well congratulate ourselves that we are favored at one of its earliest meetings to receive the members of this, the Mining Society of Nova Scotia, as our guests. Not great agriculturally, Nova Scotia must acquire wealth, population and position through the development of her mines and manufactures and her fisheries, and our progress as a people depends directly on the amount of brains and ability brought to bear on the conversion of our stores of mineral wealth into commodities. In this work most important to us we will owe a great deal to the Mining Society, and to it we wish all success. The progress of this Province, although not very rapid, has been steady and satisfactory, and I give a few figures to show that progress. In the last twenty years our output has increased as follows:—

Coal	from	1,000,000	to	2,000,000	tons.
Iron Ore....	"	3,500	to	57,000	"
Gold	"	11,000	to	23,000	oz.
Gypsum	"	120,000	to	160,000	tons.
Copper Ore .		Nil.		900	"

In Nova Scotia great progress has been made, and in Pictou County, where we now gather, much more proportionate progress has been made in the Province as a whole.

Coal mining in Pictou County on a systematic method com-

menced about 1818 at Albion Mines, and some years later a small lot of iron ore was smelted. This experiment was not repeated. The iron manufacture in Picton County was first commenced at the works at Albion Mines for the use of the Mining Association about 1837-39. At these shops a little work was done for the public, but public patronage was not desired.

The first foundry at New Glasgow, that of William Fraser, was opened in 1857. Ten years later Isaac Matheson commenced the foundry and machinist business, which still continues under the name of I. Matheson & Co.

In 1872 the Nova Scotia Forge Co. came into existence on a small scale, and as is well known has grown into the Nova Scotia Steel and Forge Co., with a reputation wider than the Dominion.

At about these and later dates iron working establishments for the manufacture of stoves, bridges and agricultural implements have followed one another, until now the business has assumed large proportions. There are in New Glasgow eight establishments, employing 600 hands, paying $200,000 in wages and producing $750,000 of product each year.

There are now at Ferrona and Bridgeville two plants of most improved character for the production of ordinary and of charcoal pig, thus producing in our midst the raw material for all iron working business, of best quality. There can be no doubt that in future the product of these furnaces will be more and more utilized.

For many years, from about 1825 to about 1885, for a period of 60 years, the great industry of wooden ship building was a mainstay of business in New Glasgow, but for many years no vessel has been built here. Now in this year, 1893, an iron steamer is being built in the long deserted ship yard by I. Matheson & Co., two of the members of the firm being members of the firm of J. W. Carmichael & Co., which for many years did the principal business in wooden ships. Let us hope that the steamer now building is but the first of a fleet which will make the name

of New Glasgow familiar and famous in as many seas as did the old time clippers of the days of white wooden ships.

Nova Scotia has, as we are frequently reminded, great wealth of mineral, she has an ingenious, apt and well endowed race of men, and both in body and mind these are well fitted to compete with all comers.

All she requires is trained and educated management, and capital which will come as soon as it is evident that good investments are offered. In conclusion, I have much pleasure in extending a cordial welcome to our visitors, with best wishes for the success of the Mining Society of Nova Scotia. (Applause.)

MR. H. S. POOLE—As a native of Pictou County, it gives me additional pleasure to acknowledge this most gratifying reception you have given to our Society on its first visit to New Glasgow, and I am sure, from the address of Mr. Bell, all here who are natives of this county, cannot but be flattered with the position in which he puts us. He himself very worthily represents New Glasgow in the interests of mining at this meeting, for he is a namesake and descendant of the first practical miner who came into the county. The name of Adam Carr appears on many of our mining plans in connection with the early workings of 1815 to 1827.

As for the objects and hopes of our Society, Mr. Bell has touched on some of them, and in coming here we hope to gain your interest as well as to enjoy a pleasant outing. "All work and no play makes Jack a dull boy," we recognize, and therefore do not confine our meetings to the reading only of papers, and discussing matters of grave moment. But if we did, we have had in a paper lately read by your fellow townsman, Mr. W. G. Matheson, one of exceptional value and so practical that alone it would justify the formation of such a society as ours.

But in holding our meeting here in New Glasgow we have yet another object in view. Would you be surprised to hear we desire to have it known that we are not engaged in a criminal occupation, that we are not necessarily all criminals because of

our occupation, and yet in the matter of legislation we are treated as criminals, we are not consulted in the preparation of legislation that specially affects us. We do not doubt that the alterations in the mining laws are made with the best intentions for the preservation of life and property, but the amendments made are not always practical, their bearing is sometimes wider than was intended, and we ask for your interest to have this grievance removed, that alterations in mining laws should only be made after careful consideration and consultation with those who are most interested in the mining industry.

We have here on the tables and walls maps and articles connected with our early mining history. The large plan and sections were made by Mr. Peter Crerar, in 1834-8, for the first railroad built in Nova Scotia, and not only are they worthy of study on account of their age and neatness of execution, but because they were made by one who had never seen a railway. When they were sent to England on approval they were accepted without alteration, and Mr. Crerar was put in charge of the construction. Then we have a series of safety lamps ranging from the dim Davy to the modern Thornbury, giving seven times the light, and with it the strong electric portable lamps with primary and also secondary cells.

Then there is a series of anemometers, one of which is forty years old and still serviceable; and presently we shall show you the Fleuss apparatus that enables a man to enter noxious gases and yet breathe oxygen which he carries with him in a compressed state.

On the wall opposite there is a geological map of the Pictou coal field as it was supposed to be twenty years ago, and another map as some of us now think its structure should be shown. I am glad of this opportunity to refer to matters geological, for gentlemen connected with the promising copper industry in Cape Breton have, at this meeting, joined our Society, and it is to a discovery made by Mr. Hugh Fletcher, of the Geological Survey (applause), that we are indebted for this addition to our mining interest.

I would again thank the people of New Glasgow for the exceedingly flattering reception given to the Mining Society of Nova Scotia.

The Hon. J. W. Longley having followed with a few appropriate remarks, the Chairman called upon the Rev. George Patterson, D.D., New Glasgow (the historian of Pictou County), who contributed the following address:—

THE EARLY HISTORY OF MINING IN PICTOU COUNTY.

By Rev. Dr. Patterson, New Glasgow.

Coal was first discovered in this county in the year 1798, on a brook near Stellarton, which passed through the rear of the farm lots of the Rev. James McGregor, D.D., which fronted on the East River at the bridge and northward, and of William McKay, Esq., which adjoined it to the north. In the same year William Fraser, surveyor, carried a sample to Halifax to the governor, Sir John Wentworth, who sent him with it to Admiral Sawyer, who ordered a small cargo to be sent to Halifax. This was done but it did not prove of good quality. In the following year occurred a contested election for the county of Halifax, then including Colchester and Pictou. The last day's polling was held at the East River, when the doctor entertained the candidates and some strangers to dinner, and as a curiosity he had prepared a fire of the coal dug out of the brook. The event excited quite an interest, partly from its novelty and partly from its bearing upon the future interests of the Province.

Soon after the doctor and some of his neighbors took out licenses from the Government to dig coal, but he was the first in the county to use it as fuel. He first opened a pit on what is still known as the McGregor seam, discovered on his own land and used the coal in his house. This was as early as 1802

From that time he regularly in the autumn got out his winter's supply, and sometimes sold some. Previously the blacksmiths had used charcoal in their work, but now John McKay, of Pictou, commenced sending lighters up the river, and took the coal to town for use in his smithy, and the blacksmiths in other places followed the same course.

I may explain here that in the earliest grants of land in the Province, the mines of gold, silver and coal are reserved to the Crown. At a later date lead and copper were included in the reservations, and still later, in the year 1808, iron, and in fact all other minerals. It will thus be seen that over a large part of the country the iron deposits belong to the proprietors of the soil, but in all cases the coal mines are the property of the government, and are worked under lease from it.

In the year 1807, John McKay, squire's son, but usually known as collier, obtained a license to dig for the inhabitants, and at a later date to export. The former licenses, as I understand, only authorized parties to dig for their own use. He and and his father commenced working a small three-feet seam on the farm of the latter, but it soon became exhausted. They then searched farther and found what has since been known as the "Big Seam," though they did not know its value. John continued to work at this for some time, selling the coal at the pit's mouth, and sending it down the river in lighters. A demand sprang up for it during the war, to supply the garrison, navy and inhabitants of Halifax, so that in the year 1815 we find 650 chaldrons exported.

After the peace the price fell to half its former rate. Owing to this, and perhaps other causes, Mr. McKay failed, and was imprisoned, while his property was seized by Hartshorne, of Halifax, who had been furnishing him with supplies. The workmen being unpaid, the latter tried to compromise with them, but they persisted in claiming full payment of what was due. Mr. Adam Carr, who was one of them, joined with Edward Mortimer, of Pictou, then one of the most influential men in the Province,

and by his influence the Government was induced to let the mines to the highest bidder. In that way they obtained the lease of them in the year 1818. They worked together till the death of Mortimer in the following year, when, on the 3rd of November, the lease was tranferred to George Smith and William Liddel. Smith and Carr worked for a time in partnership, but afterward separated, when the latter got the whole into his possession, and continued to mine for several years, raising the coal with a gin-wheel by horse power, selling it at the pit mouth and carting it to the river, where it was sent away in lighters. By a report to Government it appears that from 1818 to 1827 the amount of coal raised in each year averaged over 2,200 chaldrons.

In the year 1825, the British Government leased all the reserved mines of Nova Scotia for sixty years to the late Duke of York, excepting, of course, those which had been already leased to other parties. The Duke's lease was transferred to Messrs. Rundell, Bridge & Rundell, the celebrated London jewellers, in payment of his debts, and from them to the General Mining Association, in which, I believe, they were large shareholders.

On obtaining their lease, they sent an agent to the Province to explore for minerals, and on his report, resolved to commence operations at the East River. They purchased Mr. Carr's lease, and having about the same time secured the rights of the lessees of the Sydney mines, they thus became possessors of all the coal mines of the Province.

Early in the summer of 1827 they sent out Mr. Richard Smith, intending to commence operations both in coal and iron mining. In June a vessel arrived in Pictou bringing machinery and implements, with colliers, engineers and mechanics. Without delay he commenced sinking new shafts to the depth of 212 feet and erecting the proper machinery for working the coal mines on a larger scale and in a more scientific manner than hitherto. On the 6th September their first coal was raised, and on the 7th December a steam engine of 20 horse power was in operation, the first ever erected in the Province. A foundry was established in

which were cast rails for a tramway, which they constructed from their works to a point a little below New Glasgow. Here chutes were erected, and vessels drawing not more than six feet of water were loaded. To load larger vessels they constructed lighters, in which the coal was conveyed to South Pictou, or the loading ground, as it was commonly called, at the mouth of the river. They also employed two steamers, a small one built in Pictou for the river navigation, and a larger one from England for coasting and carrying the coal to market. The first of these, which made her first trip on the 17th July, 1830, was the first steamer that ever plied in our harbour. This plan of loading being slow and tedious, they next resolved on deepening the river. For this purpose they obtained an Act of the Legislature, giving them full authority over the river, so that no vessel drawing over six feet of water was to enter it without their permission, and only on paying toll to them. But in passing the Act, the Assembly, which had resented the conduct of the British Government in transferring our mines and minerals, added a clause, to the effect that the bill was not to be construed as admitting the right of the home authorities to dispose of our mines in the way they had done. In consequence of this the Act was disallowed at Downing Street, and at the same time a feeling of opposition having arisen in the country against such a monopoly, the scheme was abandoned.

The company continued, therefore, to ship their coal in the manner described for several years, but the demand was greater than they could supply, and the long delay of vessels in receiving their cargoes, was a great discouragement to the trade. In the meantime the use of locomotives or railroads had been tried successfully in England. Accordingly it was resolved to build a railroad from the East River to the Loading Ground for the carriage of their coal in that manner. The road was laid out in the year 1834 by the late Peter Crerar, and work began upon it in 1836, but it was not opened till the 29th September, 1839. The engines used upon it, of which there were three, named

the Samson, Albion and Hercules, were built by Timothy Hackworth, who competed with Stephenson at the first trial of locomotive engines in England. They were, for their size, powerful, though slow, and continued to do duty till lately. One of them, the Albion, is now on exhibition at the World's Fair at Chicago. This railroad, which was about six miles long, was extremely well built, but in the year 1886, the use of it was abandoned, it being found more convenient to ship over the government lines.

When the Association commenced operations, they designed to work the iron, as well as the coal deposits, known to exist on the East River. For this purpose, soon after they had completed their arrangements for raising coal, they erected a small blast furnace near the mines. They mined some ore from a bed of red hematite, at Blanchard, and collected a quantity of boulders of limonite in the neighborhood of Bridgeville, principally on the farm of James McDonald, afterward purchased by them. But the vein was not discovered, and on attempting to smelt the ore thus collected, through some defect in their mode of operation, they were unsuccessful. Efforts were made by various explorers to find the vein. The first who claimed to have found it was Dr. Honeyman, about 20 years ago, but his claim was disputed by Mr. Hartley. It was left to Sir Wm. Dawson, two years later, to define the position of the vein, which he found to be at the junction of the Carboniferous and Silurian formations. No further attempt was made to develop the ores till within the last two years, when the works at Bridgeville and Ferrona, which the Society have had to-day the opportunity of examining, were commenced.

The Association spent large sums in developing their coal mines. At that time few of the inhabitants of the Province, except in the city of Halifax, or near the coal mines, used coal in their dwellings, and there were few steamers or steam engines, so that the home market was limited. But such was the demand in the United States, that their difficulty was in finding means to raise or transport a quantity sufficient to supply it.

The Association suffered much at different times from fire or explosions. The worst of these took place in the year 1832, and 1839. These involved such destruction of the works that pits which had been equipped at great cost had to be abandoned, thus subjecting the Association to heavy losses.

In the year 1856 the monopoly of the General Mining Association was abolished. This immediately led to great activity in exploring for coal. The result was the tracing of the seams toward the westward, and the commencement of mining at Westville, and at a later date the discovery of workable seams at Thorburn, and the commencement of mining there.

But our subject is the *early* history of mining in this county, and as this change introduced a new era in coal mining, our task may be considered accomplished, and the history of the of the subsequent development of our mining industry must be left to some future examiner. (Applause.)

On motion, a very hearty vote of thanks was conveyed to Dr. Patterson, for his very valuable contribution. Thereafter the company enjoyed the evening in social intercourse, in examining the many interesting exhibits, and before finally adjourning in a dance.

EVENING SESSION.

THE DUTY ON MINING MACHINERY.

On the return of members from the Reception, a business meeting was held in the Vendome Hotel, New Glasgow. There were present: John E. Hardman, Oldham; Duncan McDonald, Truro; R. H. Brown, Sydney; C. Fergie, Westville; T. R. Gue, Halifax; Geo. W. Stuart, Truro; B. C. Wilson, Waverley; James A. Fraser, New Glasgow; Dr. E. Gilpin, Halifax; W. G. Matheson, New Glasgow; Wm. Smaill, Londonderry; John. F. Stairs, M.P., Halifax; D. C. Fraser, M.P., New Glasgow; Hon. J. W. Longley, Halifax; B. T. A. Bell, Ottawa, and H. M. Wylde, *Secretary.*

In the absence of Mr. Poole, President, Mr. J. E. Hardman, Oldham, was called to the chair.

The minutes of last meeting were read and confirmed.

A proposed amendment to Constitution was, owing to the absence of Mr. Poole, the proposer, held over until next Quarterly General Meeting.

Mr. T. R. Gue, chairman of the sub-committee appointed to consider a statement of the various classes and kinds of mining machinery manufactured in Canada, presented his report, copies of which, before being adopted, had been mailed for revision to Messrs. Matheson, Robb and McDonald, and other manufacturers of mining machinery.

MR. B. T. A. BELL having explained what action had been taken in the matter by the General Mining Association of Quebec, the statement was adopted. (See Appendix).

MR. JAMES BAIRD, seconded by Mr. C. Fergie, then moved the following resolution: "That the various members of parliament for Nova Scotia be requested to exert their influence to

have the language of the Act relating to the free importation of mining machinery changed to read as follows: 'That all tools, machinery and appliances for mining, quarrying, smelting, refining and concentrating and other processes, for the mining, extraction, and treatment of ores and minerals, of a class or kind or pattern not manufactured in Canada, be admitted free of duty, and that a copy of this resolution be forwarded to the Honourable the Minister of Customs at Ottawa, and to the General Mining Association of the Province of Quebec."

After discussion the motion was put to the meeting and carried unanimously.

The meeting then adjourned until eleven o'clock next morning.

THE INTRODUCTION OF AMENDMENTS TO COLLIERY LEGISLATION DISCUSSED.

Meeting was called to order in the Vendome Hotel, Friday, 30th June, Mr. H. S. Poole, President, in the chair.

MR. B. T. A. BELL moved the consideration of the question concerning the appointment of a committee to interview the premier in reference to the introduction of provincial mining legislation without proper consideration and hearing of proposed amendments.

MR. G. W. STUART seconded.

DR. E. GILPIN—I have no hesitation in saying that I do not believe in making legislation until it is first discussed from the three standpoints: 1st. The Government. 2nd. The men. 3rd. By the owners—so you would have all the different interests involved in it. In the recess of the Legislature each party could come before the Government and give their views on any proposed legislation.

MR. H. S. POOLE said: I feel very strongly on this question. We have had amendments made from time to time to the

Mining Act, by parties who have had either an axe to grind or who fancied they were born legislators—legislation which it was thought would rectify more or less certain evils. I have had a finger in it myself. The reformers have sometimes seemed to think that when a man was killed in a particular way, that regulations could be provided by legislation which would prevent any accident of that character occurring again. We have had a great deal of legislation, much of which has never been put into operation. I maintain that legislation which is not put into force should be wiped out. An act of parliament should be carried out or dropped.

In 1872 when the original Mines Regulation Chapter was drafted before it came before the Legislature, copies were distributed and it was discussed by those interested. That practice should be carried out with respect to amendments to both Acts. Last winter legislation was passed and the Commissioner of Mines had not an opportunity of conferring with those interested in mines; he was not consulted, the legislation was introduced entirely without his knowledge. Do you think that that was respectful to the position which he occupies? I consider it was not. He might have said to the House, I am the Commissioner of Mines, and no legislation should be admitted into this House without passing through my office: if the Government chooses to ignore me I will not be the Commissioner any longer. It is due to me and to my position that legislation affecting mines should be submitted to me first.

The Mining Society expressed a hope that this would be done, but although that hope was not realized, I am glad for my part to think that the indifference in question was not as some suppose an intentional slight to our Society. A little consideration will, I trust, make this clear to all. The snub intentional could not be for the ability to conceive it would carry with it a perception of disrespect to the Honourable Commissioner of Mines in the introduction to the Upper House of legislation touching his Department without consultation first had with him.

To snub intentionally and ignore him wilfully would go together. To ignore wilfully would imply the belief in his usefulness, while all who frequent the Mines Office know the broad grasp he has of his Department, and the urbanity with which all are received by him.

That he himself did not so regard it, is, I think evident, so also with the passing over of himself and his Department, it was no indication of the Upper House doubting his usefulness. The offence then, if you can call it one, was one of omission and not one of commission. I do not think that there was any premeditated intention of ignoring this Society last winter. I do not think it was seen that to ignore our Society was also to reflect on the Commissioner of Mines, for it was tantamount to saying to the public, the Commissioner of Mines is not fit for his office; we no longer trust the Commissioner or the work of his Department, and we allow anybody in the Upper or Lower House to introduce any amendment to the mining laws at the last hours of the session, let it pass and take its chances as to whether it is a fit and proper amendment to meet the cases supposed. I think the matter should be laid before the Executive Council, and that we should ask that legislation affecting one of the established Departments should not be allowed to pass when introduced by a private member after the House is in session, unless it has been previously submitted to the Government during recess, and an opportunity given for those interested to consider it.

I would like very much to have the experience of Mr. James A Fraser, because when he was a Member he took a great deal of interest in the mining legislation of this county. This is certainly a matter which should be redressed.

Dr. E. GILPIN—What I understand from your views is that the Government should make no alterations in the Mining Acts without it came from the Mines Department?

Mr. POOLE—Quite so, and that there shall be a general opportunity given for discussion and to hear the views of those affected, if it be a question between men and masters, or royalty-

payers and the Government. Then the legislation should be endorsed by the Department of Mines. The antagonistic parties should have an opportunity of being heard before it is introduced on the floors of the House. It has been disrespectful to the Government, it has been disrespectful also to the Commissioner of Works and Mines, that the work which should specially appertain to his Department has not passed through his hands.

MR. JAMES A. FRASER—I would suggest that in view of any legislation to be introduced next winter that notice of it should be published in the *Royal Gazette* or daily newspapers.

MR. POOLE—Provided the Department of Mines approved of it.

MR. JAMES A. FRASER—You would not get the Government or private members to agree to that. You might get by common consent a ruling that for legislation of that kind due notice should be given. Notice must be given in the *Canada Gazette* of certain kinds of legislation which goes through the Parliament of Canada. You might get a similar rule in regard to mining legislation.

MR. POOLE—Should it not be a Government measure? Surely any legislation affecting a matter of which the Government has a Department should be a Government measure.

MR. JAMES A. FRASER—They would not submit to it. The Government has got to be politic in its movements.

MR. POOLE—But then it has made some of these amendments thinking they were pleasing to certain voters. I contend the full bearing of some amendments was not seen, nor when it was thought a benefit was being done to one class it was hurting others. For instance, I contend that Mr. Fielding did not see the full bearing of the legislation last winter.

MR. JAMES A. FRASER—I agree with you with regard to publicity of mining legislation before its introduction into the House. Your object is to get any proposed legislation made public previous to the meeting of the legislature for the purpose of in-

formation and discussion and hearing all parties who are interested in connection with it. What we want to get at is that.

Mr. POOLE—A committee might wait upon the Government and urge upon it to make all mining amendments Government measures, and that the same should receive the sanction or consideration of the Department of Mines before being introduced.

Mr. JAMES A. FRASER—Notice of the legislation should be published for at least three months in the *Royal Gazette* or in a couple of newspapers. It would simply be following out the lines which should be laid down in regard to municipal laws of the towns and counties. Some of this legislation had taken its rise in the Provincial Workingmen's Association, and if we can get the Workingmen's Association to agree with us, and we ask their co-operation, they will certainly agree with us. They want publicity as well as we do.

Mr. POOLE—Because when an Act of the Legislature is improperly worded they do not know when it is going to pinch them or pinch us. I have always been perfectly satisfied where a matter was clear and just to leave it to the workingmen.

Mr. JAMES A. FISHER—Go to those men frankly and ask them for their co-operation and explain it to them, and I have no hesitation in saying they will be one with us. When Mr. Drummond was before the Legislature he stated : "I am entirely opposed to the managers from the men's standpoint. I do not come here in a double capacity, I come here in an advocate's capacity," but I am satisfied you will find him reasonable in this matter before a delegation.

Mr. R. H. BROWN—I also remember his saying on one occasion in the Commissioner's Office, "I am here as the paid agent of the Provincial Workingmen's Association."

The resolution was then put to the meeting and carried, the President nominating a deputation to interview the local government.

THANKS TO LOCAL COMMITTEE.

MR. B. T. A. BELL then moved a vote of thanks to the various gentlemen composing the local reception committee, who had so thoughtfully provided for the entertainment of the members and the success of the meetings.

MR. J. E. HARDMAN having seconded, the motion was put and carried unanimously.

OTHER EXCURSIONS.

During the morning parties of members were driven to the top of Grant's Mountain, and greatly enjoyed the magnificent view of the surrounding country. Others visited the well equipped establishment of the Nova Scotia Steel and Forge Co. at New Glasgow, the new steel steamer being built by Messrs. Matheson & Co.; and others, at the invitation of Mr. Fergie, drove out to Westville and inspected the Drummond Colliery.

NOTE ON AN OCCURRENCE OF MANGANESE AND ZINC ORE IN NOVA SCOTIA.

—

By E. Gilpin, Jr., LL.D., F.G.S., F.R.S.C., etc.
Deputy Commissioner and Inspector of Mines, Nova Scotia.

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These brief notes are intended only to bring to the notice of the members of the Society an occurrence of manganese in a form which is, I think, new in this Province, and of an interesting specimen of zinc ore.

In the case of the former, samples of rock were brought to me from Whitehead, in Guysboro' County, which had excited the curiosity of the discoverer by the readiness with which pieces of it fused in an ordinary fire. This ready fusibility of certain rocks is not generally known, and is usually considered a mark of the presence of some valuable metal. In this case the metal was for some reason unknown to me considered to be zinc. The rock, a sample of which is submitted, is light brown and grey in color, weathering to a light drab. It is hard, brittle and sub-granular in texture. The sample shows a folding in the shape of the letter S, and has crevices, apparently due to the folding, filled with crystalline matter slightly darker than the surrounding rock.

The samples, although resembling in a general way the rocks called felsites, had features of novelty about them, and I sent some to Mr. Leckie, manager of the Londonderry Iron Works, and the analyst of the company, Mr. Smaill, was kind enough to make a partial analysis of it. He reports that it contained:—

Silica	70·25
Alumina	15·25
Manganese oxide	9·25
Iron oxide	Small quantity
Lime	do
Magnesia	do
Zinc	none

The remainder being probably moisture, with some potash, soda, carbonic acid, etc.

Having disposed of the zinc theory, the presence of manganese became interesting. Presumably the manganese present is in the form of a bi-silicate of manganese, such as rhodonite, and that the greyish red or brown color of part of the sample may be due to the partial penetration of the rock by some carbonate of lime, manganese, etc. Dana, in his mineralogy does not give any analyses of the varieties of the silicates in any way resembling that under consideration. Allowing for the presence of a certain amount of free silica, as is usually the case in rocks of the class under consideration, the analysis given by him of orthoclase, present a parallelism with the exception of the absence of potash and the presence of manganese, the typical composition of this mineral being :—

Silica	64·60
Alumina	18·50
Potash	16·90

It would appear probable that the manganese has replaced nearly all the potash. The addition of moisture and free silica, and the replacement of part of the alumina and potash by the small quantities of iron, lime and magnesia would give a compound almost identical with that before you. All the analyses of orthoclase given on pages 356 to 361, of Dana's Mineralogy, have silica contents of from 64 to 75 percentum, and contain iron, magnesia, lime, soda, etc., in varying amounts up to about four per cent.

The same may be said of the possibility of the manganese having replaced the soda in an albite, the typical composition of which is :—

Silica	68·6
Alumina	19·6
Soda	11·8

In this case also the other foreign oxides would have replaced part of the soda and alumina.

It appears that feldspars are altered by the action of waters containing carbonic acid, or alkalies, or rendered acid by the decomposition of sulphurets. The completion of a course of decomposition of feldspar by the agency of water containing carbonic acid is the formation of a kaolin, or hydrous silicate of alumina; but there are many intervening steps, modified by circumstances. Thus the presence of lime, iron, etc., leads to changes in composition, forming one or more links in the process. In the case before us it would appear that the mineral most convenient or most applicable has replaced the potash or soda, and marks an important change in the ultimate decomposition of the rock.

The following analysis given by Dana, of minerals resembling most closely in their silica and alumina contents the sample from Whitehead, may be of interest:—

	Silica.	Alumina.	Iron Ses. Oxide.	Magnesia.	Lime.	Soda.	Potash.	Water.
1. Allbite........	71·60	14·75	1·41	trace	1·06	10·06	·32	....
2. do	70·68	19·80	·11	...	·23	9·06	.....	....
3. Sanadin.......	67·42	15·88	2·83	·15	2·77	·43	10·55	....
4. Microlin......	66·9	17·8	·5	...	·6	6·5	8·3	....
5. Felsite........	71·17	13·6	1·40	·1	·4	.....	3·19	3.5
6. Pumice.......	70·00	16·00	·50	...	2·50	.....	6·50	3·0

Professor Lawson has kindly handed me an analysis of "Rhombohedral Feldspar" occurring near Rome, by Jameson. This is apparently a Lepidomelane with most of the iron replaced by manganese and lime.

The following is a comparison of the two minerals:—

	Lepidomelane.	Rhombohedral. Spar.
Silica....................	39·45	40·20
Alumina.................	9·27	9·00
Iron oxide...............	37·23	1·10
Manganese oxide.........	2·54	12·60
Lime....................	·31	20·80
Magnesia................	3·29	....
Potash..................	5·06	12·00
Water...................	1·83	....

The analysis given by Dana, p. 238, of Gamsigradite, so named from the locality in Servia where it forms with white feldspar a rock termed timazite. It is an aluminous iron manganese amphibole, and contains:—

Silica	46·58
Alumina	13·63
Iron	12·29
Manganese oxide	6·00
Magnesia	8·84
Lime	8·83
Soda	3·17
Potash	1·00

I do not know that manganese presented in this form is of commercial value, but its occurrence in connection with the gold-bearing strata is interesting. If the rock under consideration is to be viewed as a volcanic slag, and as having carried up its manganese contents from some unknown sources, there must be large amounts of this element contained in some silicates, and their decomposition may often prove to be the source of the deposits of manganese ores found in later rocks.

Since writing the above, I have noticed a reference showing the practical relationship of rocks containing manganese to deposits of the ores of that metal of economic value. Mr. Halse, in a paper read recently before the North of England Institute, describes some manganese deposits, in one of the hills north-east of Arenig, consisting mainly of Upper Trappean rock, with a mass of feldspathic porphry. He states, from a careful examination of the veins, that there is no evidence of their being fissure veins, the manganese merely locally filling the joints and certain superficial fissures in the country rock. It appears that the manganese has come from the feldspathic ash itself, and as a result of surface decomposition and erosion has been leached out from it and deposited in the joints and fissures.

It is to be regretted that analyses of the country rock were not given. The mode of occurrence of the ore described by Mr.

Halse is that usually affected by manganese, and a good example may be seen near the Salmon River of Truro.

The other sample is a compound containing zincite, red oxide of zinc; Franklinite, an iron black compound, iron, manganese and zinc, and Willemite, a whiteish silicious oxide of zinc.

This was found at Forrest Glen, on the line of the survey of the Stewiack and Lansdowne railway, by Mr. T. Ritchie, civil engineer. The samples were submitted to Mr. Fletcher of the Geological Survey. He expressed a doubt as to the specimen being from any local deposit on account of its strong resemblance to the New Jersey ore. Mr. Ritchie, however, assured me that he had made full enquiry, and was satisfied that the sample had not been introduced, but was actually discovered. I give the occurrence as of interost on account of the rarity of zinc ore in the Province of Nova Scotia. It is found in small quantities in the gold bearing quartz veins, as traces in manganiferous ores, and occasionally in the carbonate ores of the coal measures.

In New Jersey, at both Franklin and Sterling, these three ores occur together, and in such quantity as to furnish an important ore of zinc. If, on further examination, the authenticity of the occurrence at Forrest Glen is confirmed, and the float traced to its source, an important addition may be made to the list of our mineral resources.

THE NEW WORKS OF THE NEW GLASGOW IRON, COAL AND RAILWAY COMPANY AT FERRONA, N.S.

By Walter Stein, Philadelphia, Pa.

The actual work on the plant of this company commenced in April, 1891, a great deal of preliminary work had, however, previously been done; the plant was put in operation September, 1892. The works comprise the following departments:—

1st. A complete railway system, connecting the ore and stone quarries with the furnace plant, and with the I.C.R.R. at Ferrona Junction.

2nd. Numerous ore mines, limestone quarries, ore washers, etc.

3rd. A complete coal-washing plant.

4th. A complete coking plant.

5th. A complete blast furnace plant.

The ore and limestone is brought to the stock house on the company's own railway. This stock house is a large wooden structure, covered with corrugated iron. The size of the building is 91 feet in width, by 250 feet in length, thus giving a large floor space to store ore, limestone, etc. The ore has been washed before it is stored in this building. The coke used in the furnace is brought to the stock house from the ovens in the charging buggies, two of which are placed on a flat car pulled by an endless rope, these loaded buggies go right to the furnace, two empty ones being returned on the car to the coke ovens to be loaded.

Within the stock house are located the stock scales, on which all material (stock) going into the furnace is weighed.

The ore, limestone and coke from the stock house is now taken to the top of the blast furnace by means of a double elevator, located in an all-iron hoist tower. The elevator cages are

worked by an automatic hoist engine, located at the foot of the hoist tower.

The hoist tower is connected on top with the blast furnace proper by means of an iron bridge. The buggies, with material are dumped on the bell of the furnace, which is lowered or raised by the top-filler by means of an air cylinder.

The blast furnace proper is of modern design and fitted up with the most modern appliances. The clear lines of the furnace inside of the brick work are: Height, 65 feet; bosh, dia., 15 feet: dia. of crucible, 9 feet, 9 inches. There are eight tuyeres and two cinder notches located within the crucible.

In front and surrounding the furnace is the casting house, 50 feet wide, by 135 feet long, constructed entirely of iron. The pig iron is taken from this house on little cars to a scale located at the end opposite of the furnace. After being weighed the pigs are broken in half, graded into the different qualities, and stored in the pig iron yard ready for shipment.

The furnace has two downcomers (gas flues), one carries the gases to the hot blast stoves, the other to the boilers. There are three hot blast stoves, of the three-pass Massick and Crooke type, each stove being 16 feet 6 inches in diameter inside of the shell, and 60 feet in height. There is also located a chimney on top of each stove, 4 feet in diameter by 35 feet in height.

Each stove is lined with about 160,000 fire bricks. The aforementioned downcomers bring the gases from the top of the furnace to dust catchers and gas washers located at the bottom; from here the cleaned gases are either taken to the stoves to heat them or to the boiler plant to raise steam. The air necessary to smelt the ore, etc., in the furnace, is produced by two powerful blowing engines, each weighing about 90 tons. These engines have steam cylinders of 36 inches diameter, air cylinders of 84 inches diameter, and 4 foot stroke. The cold air leaves the blowing (air) cylinders of the engines under considerable pressure. It passes through an iron pipe 30 inches diameter (cold blast pipe), to the previously mentioned stoves, while two stoves are

being heated by the waste gas, the third stove receives the cold air from the engines, this air becomes very hot while passing through the red hot brick work of the stove, and is taken by means of a fire-brick-lined (hot blast) pipe to the tuyeres of the furnace, thus reducing the fuel consumption very materially as compared with the old style furnaces, where the air from the engine is used cold.

The blowing engines are located in a brick building of very strong design. The building is 35 feet wide by 60 feet long, and 35 feet high below the roof truss. This building contains also two powerful boiler feed pumps, two feed water heaters and various steam, pressure and air gauges.

The steam required is generated at the boiler plant, comprising four double batteries of tubular boilers, designed to carry a pressure of 100 pounds per square inch. Each of the eight boilers is 6 feet in diameter, 20 feet long, and contains 52 tubes, each 4½ inches in diameter. The boilers are heated by the waste gases, the draft is produced by an all-iron chimney, 7 feet 6 inches in diameter by 125 feet in height. The chimney is lined with fire-bricks 4 inches in thickness.

The boilers are located in a wooden boiler house, with a tile covered roof; this house is 42 feet wide by 94 feet long. The water required is pumped by two powerful duplex pumps, from the East river, direct into an iron stand-pipe (water tower) 10 feet in diameter, 80 feet high; all water used at various points of the plant comes from this stand pipe under a pressure of about 40 pounds.

The company also has a fully equipped chemical laboratory, where all ores, etc., are carefully analysed as far as necessary. Besides the aforementioned appliances, there are numerous other machines, etc., amongst these two complete ore washers, two locomotives, cinder cars, railroad cars, etc.

A large number of steam radiators, etc., are provided wherever there is danger of freezing in winter.

Coal Washing Plant—This plant was put in successful operation in May, 1892, and has been in constant operation ever since. The plant was built with the idea of washing the fine coal from various mines, the washed coal to be used for coke purposes. In connection with the coal washing plant, there is a retort coke oven plant of 54 retort coke ovens, having a daily capacity of about 175 tons of coke. The coke is pushed out with a special machine, a coke pusher. The drawing (see plate) shows the general arrangement of the washing plant, C 127.

The coal from the various mines arrives on the railroad tracks A1 and A2, and is dumped into the pits B1 and B2 (a different kind in each pit). From these pits the coal is taken by means of bucket elevators C1 and C3, to the shaking screen D. This shaking screen has double eccentric motion, imitating hand screening as much as possible; the mesh of the screen is $\frac{3}{8}$ of an inch.

The material too large to pass through the perforations drops into the crusher rolls E1 and E2, and is again taken after the crushing, to the shaking screen D, by means of the bucket elevator F.

The coal passing through the shaking screen D is taken by means of the bucket elevator G to the separating screen drum H, which separates it into three sizes: 0 to $\frac{1}{8}$ in., $\frac{1}{8}$ in. to $\frac{1}{4}$ in. $\frac{1}{4}$ in. to $\frac{3}{8}$ in.

The different sizes are carried by means of chutes to the various jigs J to J8. These are all two-compartment feldspar jigs, arranged with variable stroke. Each screen compartment is 28 inches wide and 49 inches long, so that the coal must travel a distance of over eight feet while being washed.

The washed coal flows in gutters to the large elevator boot K2, and is elevated from there to the top of the storage tower by means of the perforated bucket elevator I2, which discharges the coal on the distributing conveyor M, which distributes it into the various compartments N of the large storage tower.

The two jigs shown in dotted lines, the elevator boot K, and

the elevator I, are arranged to be put in if the plant requires enlargement.

The slate from jigs J to J8 is discharged into elevator boot Q, and is taken from there by means of a perforated bucket elevator R, and dumped into railroad cars ready to be taken to a convenient dumping place.

T is the centrifugal pump which distributes the required water. The water after being used always returns to the centrifugal pump and is used over and over again. There is no loss of water except that absorbed by the coal, and enough fresh water must be added to make up for this loss.

N is the steam engine of 100 h.p. to drive the entire plant.

The elevators are all of special construction and have very large buckets, and automatic feed, etc., and are run at a very low speed.

As will be readily seen the entire plant works automatically and consequently requires only three men to run it.

The coal washed contains from 17% to 35% of ash besides in the neighborhood of 2½ to 3% of sulphur; the washed coal contains in the average 10% of ash or 1% more than the fixed ash (9%) of the coal. This is a remarkably good showing and is seldom equalled at any washery in existence. The fixed ash cannot be reduced by any method. Coming within 2% of the fixed ash is considered excellent work.

The sulphur is reduced by washing from 2½ to 3% down to 1·35%, the sulphur still left is organic sulphur and in combination with alumina or lime.

Jigs J to J5, was in the original plant; J6 to J8 were added when the additional retort coke ovens were built. The total capacity of the plant is now 300 tons of coal in ten hours.

Coking Plant—In addition to the coal washing plant, drawing C 127, already described, there is a battery of fifty-four retort coke ovens, Bernard's system (improved Coppée).

Drawing C 149, shows the complete coking plant. The plan shows first: A side elevation of the ovens with section G H;

second, a top view and sections A B, C D, E F, and K L; third, a cross section, M N, through the centre of the retort, and finally a cross section, O P, through the centre of partition wall between every two ovens.

1 marks the original battery of 36 ovens, built two years ago; 2, the eighteen additional ovens built in Februrary last: 3 and 4 are the chimneys for each battery in case the surplus gases are not used for steam raising; 5 shows the place where the coke pushing machine travels parallel to the ovens; 6 is the coke discharge side; 7.7 are the tracks for door lifting windlasses: 8, 8, 8 are the traks for the coal charging buggies (lorries); 10, coke pushing machine (ram): 11, hydrants to supply the cooling water; 12, gas flue; 14, 14, 14, 14, cooling flues; 15, 15, 15, coal charging holes; 16, 16, air inlet valves, for the air necessary for the combustion.

General—There are 54 retort ovens in all, each retort (oven) has the following inside dimensions: Length, 33 feet; height, 6 feet 6 inches (under roof); medium width, 23½ inches. Each oven (retort) is charged with about 7 tons of washed coal (all below ⅜ in. mesh) every 40 or 48 hours; the 54 ovens produce every 24 hours between 115 and 120 tons of first-class large coke, which is all used in the blast furnace of the company. The coal used yields 73 or 74% of large coke right along, the same coal only yields 60 per cent. max. in the bee-hive oven. Each oven can supply 130 to 150 square feet of boiler surface for steam raising if desired.

The ovens are built of the best quality of fire bricks obtainable, the composition of the fire bricks varies in the different parts of the oven and is specially made to meet the varions conditions of heat, reducing cost of repairs to a minimum, away below those arising at bee-hive ovens.

Mode of Operation—Each two ovens work together and for this reason the ovens are charged alternately; one day the ovens 1, 3, 5, 7, 9, etc., uneven numbers are pushed, the next day the even numbers, 2, 4, etc., are discharged; this arrangement

makes it possible to work a hot and cold oven together, utilizing the surplus heat of the hot oven to heat the cold (freshly charged) oven. After the process of coking is finished the doors at both ends of the respective ovens (retort) are lifted by means of the the windlasses afore-mentioned, the coke pushing machine now pushes the whole cake of coke out of the retort, landing it clear of the ovens on the discharge side (6), where it is water-cooled.

As soon as the coke is pushed out by the ram of the coke pushing machine, the oven doors are re-closed and sealed air tight with ordinary clay; the coal to be charged is now dumped into the oven through the charging holes 15, 15, 15, and levelled in the usual way.

The main advantages of these retort ovens, without saving of tar and ammonia, over the bee-hive oven are as follows:—

1st. A larger yield, 12 to 15 per cent. at least.

2nd. Considerable lower cost of coke-making (labor—expenses).

3rd. All coke produced is large and strong, there is less than 3 per cent. of fine coke—braize.

4th. Large production per oven.

5th. Fewer repairs, etc.

6th. One important advantage of the retort oven is that owing to the high temperature carried and to the high and narrow column of coal (6 feet), inferior coking coals can be successfully coked, also a mixture of coking and non-coking coal.

The ovens of the New Glasgow Iron Coal and Railway Company are the first retort coke ovens working successfully on this side of the water.

On the continent of Europe the retort oven has entirely replaced the beehive oven, and England is at present building large numbers of retort ovens to replace bee-hives; in America also competition will no doubt force the coke producers soon to adopt the retort oven, either with or without saving of the by-products.

(From Notes furnished by MR. R. E. CHAMBERS, M.E., Superintendent of the Company.)

Ore Deposits and Ore-Washing Plant—As is well known, the ore occurs at the junction of the Carboniferous and Silurian formations, in bodies of large size, which are opened at different points in the East River, extending over a distance of five miles. The ore is won by shafts or inclines, according as the pitch of the ore is more or less inclined. During the past year the ore used has come principally from the McDonald and Grant mines. Tramways, extend from the mines to the washer. The principal impurity in this ore is clay, which is easily and cheaply separated by washing. The washer used is a section of a conical revolving drum with inclined blades or fins on the inside, which work the ore from the large to the small end, while the water (from a Cameron pump) enters at the small end of the drum, washing the clay from the ore which it meets in its descent, and discharging it in spouts, which lead to the settling pond. The ore is discharged from the small end of the drum into a bin, and from thence into the cars.

The Cameron mine is situated about half a mile north from the washer, and has not been worked so far, being kept as a reserve.

There has also been used in the furnace during the last few months a red hematite, which occurs in the Lower Silurian formation as bedded deposits. This is the same class of ore as is mined at Torbrook, Annapolis Co. It occurs in large beds in Pictou Co. and also at Arisaig, in Antigonish Co.

All the ore obtained so far has been from open cuts, no systematic mining having been commenced on this red ore. The amount of ore mined is about 4,000 tons per month, including both brown and red hematites.

APPENDIX.

THE DUTY ON MINING MACHINERY.

The following is the statement of the various classes and kinds of mining machinery manufactured in Canada as prepared originally by the General Mining Association of the Province of Quebec in accordance with the request of the Hon. the Comptroller of Customs, revised and approved by Committee and adopted by the Society at its meeting held at New Glasgow on 29th June; copies to be forwarded to the General Mining Association of the Province of Quebec and the Hon. N. C. Clarke Wallace, Comptroller of Customs, at Ottawa:—

Air Compressors.

KIND.	
Ingersoll-Sergeant	Ingersoll Rock Drill Co., Montreal.
Rand	Canadian Rand Drill Co., Sherbrooke.

Mine Pumps.

Northey Single	Northey Manufacturing Co., Toronto.
Northey Duplex Sinking Pumps	do do do
Smith Patent	Smith & Co., Toronto.
Polson Cornish Pumps	Polson Iron Co., Toronto.
Cornish Pumps—various	Different makers.

Prospecting Drills.

The "Diamond" Prospecting Drill	Jenckes Machine Co., Sherbrooke.

Rock Drills—Steam and Air.

Rand	Canadian Rand Drill Co., Montreal.
Ingersoll-Sergeant	Ingersoll Rock Drill Co., Montreal.

Rock and Ore Breakers.

Blake-Marsden	Jenckes Machine Co., Sherbrooke.
Gates	Waterous Engine Co., Brantford.
Blake	George Brush, Montreal.
Not known by any special name	Burrell Foundry and Machine Co., Yarmouth, and others.

Channellers, Quarry Bars, Gadders, Etc.

Ingersoll Bar Channelers ....Ingersoll Rock Drill Co., Montreal.
Ingersoll Gadders .... do do do
Rand Channelers .... .Canadian Rand Drill Co., Sherbrooke.
Beatty Channelers and Quarry Bars . Beatty & Sons, Welland.
Own Make ....Beckett Engine Co., Hamilton.

Coal Cutting Machines.

Sergeant Percussion Coal Cutters ... Ingersoll Rock Drill Co., Montreal.
Harrison Patent Coal Drill ....Canadian Rand Drill Co., Sherbrooke.

Coal and Mineral Conveyors and Elevating Machinery.

Link Belt ....Truro Foundry and Machine Co., Truro.
Not known by any special name....Waterous Engine Co., Brantford.

Water Wheels for Gold, Slate, Phosphate and other Mineral Producing Mills.

New American ....Kennedy & Sons, Owen Sound.
Little Giant.......................Paxton Tate & Co., Port Perry.
Girard ....Canadian Rand Drill Co., Sherbrooke.
Vulcan ....Paxton Tate & Co., Port Perry.

Gold and Silver Stamp Mills.

Nissen ....Windsor Foundry and Machine Co., Windsor.
Truro Foundry and Machine Co., Truro.
Yarmouth Foundry and Machine Co., Yarmouth.

Not known by any special name.
I. Matheson & Co., New Glasgow.
Woodhouse Bros., Port Arthur.
G. & J. Brown Manufacturing Co., Belleville.
Jenckes Machine Co., Sherbrooke.

Hoisting, Winding and Hauling Engines.

Not known by any special name.
Ingersoll Rock Drill Co., Montreal.
Jenckes Machine Co., Sherbrooke.
Carriere, Laine & Co., Levis.
Doty Engine Co., Toronto.
Polson Iron Co., Toronto.
A. R. Williams, Toronto.
M. Beatty & Sons, Welland.
G. & J. Brown Manufacturing Co., Belleville.
George Brush, Montreal.
A. Fleck, Jr., Ottawa.
Miller Bros. & Tom, Montreal.
Killey Beckett Engine Co., Hamilton.
Sherbrooke Iron Co., Sherbrooke.
Macdougall & Sons, Montreal.

Hoisting, Winding and Hauling Engines—*Continued.*

Not known by anp special name.	Howell & Co., Halifax. Burrell, Johnson Machine Co., Yarmouth. Woodside Bros., Port Arthur. Truro Foundry and Machine Co., Truro. I. Matheson & Co., New Glasgow. Robb Engineering Co., Amherst. Waterous Engine Co., Brantford, and others.

Smelting Furnaces and Equipment.

Herreschoff Water Jacket Smelting Furnace for Copper Ores	Jenckes Machine Co., Sherbrooke.
Eustis Water Jacket Furnace for Copper and other ores	Jenckes Machine Co., Sherbrooke.

Electric Motors, Pumps, Drills, Hoists and Electric Mining Machinery.

Edison and other patents	Edison General Electric Co., Toronto.

Wire Rope Transmission and Tramway.

Rigid Cable Tramway and Hoisting gear	George Low, Ottawa.
Lang's Patent	Dominion Wire Rope Co., Montreal.
Not known by any special name.	B. Greening Co., Hamilton. Truro Foundry and Machine Co., Truro.

Ore Buckets.

Not known by any special name.	George Low, Ottawa. Jenckes Machine Co., Sherbrooke. Truro Foundry and Machine Co., Truro, and others.

(Signed) T. R. GUE,
Chairman of Com.

(Signed) JOHN E. HARDMAN,
Vice-President,
Chairman of Meeting.

(Signed) B. T. A. BELL,
Secretary,
General Mining Ass'n P. Que.

TRANSACTIONS

OF

The Mining Society of Nova Scotia.

The Society as a body is not responsible for the opinions and views expressed in the several papers presented with the Transactions.

VOL. II. SESSION 1893-94. PART III.

The September quarterly meeting of the Society opened at Halifax, on Thursday, 28th instant. Among those present were: Messrs. H. S. Poole, M.A., F.G.S., Stellarton; John E. Hardman, S.B., M.E., Oldham; J. H. Austen, Halifax; R. H. Brown, Sydney Mines, C.B.; Charles Fergie, M.E., Westville; F. H. Mason, F.C.S., Truro; W. R. Thomas, Montague; A. A. Hayward, Waverley; B. C. Wilson, Waverley; Dr. E. Gilpin, Jr., Inspector of Mines, Halifax; Howard Clarke, Halifax; George W. Stuart, Truro; A. Drysdale, Halifax; Geoffrey Morrow, Halifax; H. M. Wylde, *Secretary*, Halifax. Messrs. S. P. Franchot, Buckingham, and B. T. A. Bell, Ottawa, officers of the General Mining Association of the Province of Quebec, were also present as delegates from that organization.

Mr. H. S. Poole, President, in the chair.

The minutes of previous meeting having been confirmed and Mr. A. Dick, Joggins Mines, having been elected a member, the meeting adjourned until the afternoon.

THE INTRODUCTION OF NEW MINING LEGISLATION —INTERVIEW WITH PREMIER FIELDING.

A deputation consisting of the President and eight members, waited upon the Hon. W. S. Fielding, Premier of the Province, at his office in the Government Building, at 12 o'clock.

Mr. POOLE stated that the object of this visit by the members of the Mining Society, was in respect to mining legislation —legislation which is introduced as a casual matter into the House. He asked that an opportunity be given so that all sides of the question might be presented to the Government. A good deal of mining legislation had been introduced into the House, without the opportunity being given to those who are engaged in mining, of discussing it. He would submit that it should be an unwritten law that all legislation respecting mining should pass through the Mines Department.

Mr. FIELDING replied that the Government cannot put any restriction upon any member of the House introducing legislation respecting mining. In matters of importance respecting mining legislation the endorsement of the Department of Mines should be obtained. If it were proposed that the Government should interfere with the liberty of action of any member to bring forward legislation, that he could not assent to.

Mr. POOLE—There can be an unwritten practice—a private member may have a perfect right to bring in any amendment he pleases, but the Government could say: "You cannot expect the Government to consider this carefully or endorse it, unless it has had an opportunity of having it discussed by those it is going to affect."

Mr. FIELDING—That implies that no legislation is to be introduced without being considered and endorsed by the Government.

Mr. POOLE—In the matter of education does not the Government control all amendments touching education ?

MR. FIELDING—Our system has settled down now—to a general extent, any amendment of importance to the education law is brought forward by the Government, but all amendments do not emanate from the Government, but from private members as well. If you mean that you would like to urge, not as a practice, but as a reason, that all mining legislation should be considered and not done hastily, I fancy that merely passing through the Department would not satisfy you—the Department is not infallible. I assume you would like to know what was going on and that you should have an opportunity to present your views.

MR. POOLE—It would lead to that.

MR. HARDMAN—Legislation which may appear on the surface as all right, and, therefore, not specially attract the attention of the Commissioner of Mines, might have an effect very apparent to a person in the profession. If we had an opportunity of knowing in due season, what legislation is proposed, we might have a voice in the matter. I will simply mention one case which occurred last winter, the changing of the courses from the true meridian to that of the magnetic meridian.

MR. FIELDING—If that was a mistake, it was done without the consideration of the Department. The Department may not have had it under full consideration. It may have been in consequence of being introduced late in the Session. You wish to have an opportunity to present your views from the standpoint of practical miners—that I take it is the main point you urge.

MR. HARDMAN—Yes; but especially refer to the amendments brought forward by private members. We desire a chance to know what legislation is introduced, and a chance to present our objections if we have any.

MR. FIELDING—The general principle you lay down, therefore, is that mining legislation should not only receive the attention of the Department of Mines, but that the miners of the country should have a chance of a hearing? All that I agree to

MR. POOLE—There are many existing inconsistencies, *e.g.*: Why should a boy in a coal mine have shorter hours than a boy in an iron mine? New Zealand apparently took the English Act and copied whole sections from it, making restrictions of the hours concerning boys, and wound up by saying "No boy shall be employed in any capacity."

MR. FIELDING—This may not have been the intention of the Act. You must not imagine that if you have the supervision of the Mines Department and a chance to discuss the Act that this will prevent any errors creeping into legislation affecting mines. The best of draftsmen may be employed in framing an Act and yet millions of dollars may be spent in finding out what certain sections of an Act means. For instance, take the Liquor License Act of Canada.

MR. HARDMAN—A judgment was given in Quebec not more than twelve months ago to the effect that all persons are obliged, under an Act, to have a powder magazine with walls of masonry and a roof of iron.

Admitting the fact that no body of men can make perfect laws, still would it not be better to have a chance to discuss measures which are brought forward.

MR. FIELDING—Quite so. If you gentlemen agree among yourselves and furnish us with a memorandum of the amendments you propose we will endeavor to entertain them. I fancy some will be subject to contention, yet some palpable errors may be removed. If some of your members were to make a list of the amendments you propose. not the amendments themselves, but the substance of them, we may have an opportunity of eliminating errors in the Act—do not wait until Parliament meets for some suggestion—and do not take it for granted that everything you ask for will be given. We do not want to impose upon you the duty of revising our mining laws; that is our business. If you furnish us with a memorandum of what your Society considers defects in

our law, and a statement of what amendments should be made it would be in order. The Government would then reframe the Act.

Mr. HARDMAN—We simply came as petitioners to ask the attention of the Government, to obviate as far as possible all future errors which may be made. The examples we have cited are of what has been done in the past. We wish also to call attention to one other matter—formerly it was the custom, under an old Act, to keep a record of the different mine workings in the Mines Office.

Dr. GILPIN—I might simplify matters by staing that I think you are mistaken as to the authority of an Act.

Mr. POOLE—If it was not in accordance with the Act, it was in accordance with the practice of the office.

Mr. FIELDING—Gold mines chiefly?

Mr. HARDMAN—All metal mines.

Mr. POOLE—Now, we would like to see some record kept, and a memorandum published from time to time of the depth of the workings; also of the extent of the workings in this and that district, etc., which could be amended from year to year as the workings progressed.

Dr. GILPIN—Would you extend that further to locate the position of such shafts?

Mr. POOLE—Yes.

Mr. HARDMAN—I have nothing more to say in suggesting anything to the Government, but I will beg that the Mining Society should have the fullest opportunity of a public hearing in order to show Parliament whether a measure was advantageous or disadvantageous in the judgement of those affected by such legislation. In regard to the plans of deep workings, I submit that such plans would be of more value to the Province than to the individual.

MR. FIELDING—But I should think it would be desirable during the Session for the Society to have one of its members present watching against wrong-doing.

MR. HARDMAN—A lobbyist?

MR. FIELDING—I anticipated your suggestion. I am not imposing such duty upon you, but I would suggest that a member of the Mining Society should watch closely the daily newspapers, and the moment he saw that any mining legislation was introduced, he could get a copy. It would not mean a lobbyist; it would simply mean an observer.

MR. HARDMAN—In 1885 such matters could be brought before the Mines Department, and a public hearing could be obtained.

MR. FIELDING—I think there should not be much difficulty in watching the newspapers, and getting copies of any measures introduced into the House, for your own protection I think you would find it useful. I would not impose this on you as an obligation but for your protection.

MR. HARDMAN—In spite of that watchfulness, somebody would come in with a private bill which would have the effect we complain of. I tried to do as you suggest last session, but the special matter of the "meridian" already mentioned, had already reached its final stage, and I was too late.

MR. FIELDING—This bill must have passed through some critical stage.

DR. GILPIN—Some people came to Mr. Church and made representations——

MR. HARDMAN—(interrupting)—That is the very point we are driving at. "Some people," not representing the industry made "representations" to the Commissioner, and he acceded to them without giving us a hearing. As a matter of fact, this amendment means that the surveyors you have in the Province are too lazy to get the true meridian, and instead, prefer laying a magnetic course. It is a serious matter, for we have had

various instances where the variation of compasses has caused direct loss and litigation. The matter of changing to the true meridian was thoroughly threshed out by the Society's predecessor, the Gold Miners' Association, and the change to true meridian received the unanimous endorsement of the Gold Miners at that time.

MR. FIELDING—I formed the impression at the time that it was a mistake and it should be corrected. From what you tell me, it is against the opinion of the Mining Society?

MR. HARDMAN—The matter was threshed out in the Gold Miners' Association, and was recommended by that body for adoption.

MR. FIELDING—Are you all of the same opinion? I think it is a matter upon which experts may be divided.

MR. POOLE—Stone posts had been established in the coal fields years before, and the legislature had confirmed them as the correct corners, so that we have had no occasion to look into the matter.

MR. HARDMAN—I might say further, that this amendment did not effect the old areas, it was only to apply to new ground laid out subsequently to the passing of the Act. It was only in regard to new areas, they were to be laid out by the true meridian. I simply mention it as an example where legislation was passed which was not representative of the opinion of gentlemen connected with mining work.

MR. FIELDING—I remember hearing the discussion at the time the Governor-in-Council gave a hearing. (To Mr. Hardman) —At what stage of the bill did you offer your objections?

MR. HARDMAN—I went up to the House on the afternoon of the day I saw the amendment in the newspapers, and asked for Mr. Drysdale. He informed me it was too late to object, that the bill was passed.

MR. POOLE—We think most of these amendments to the mining laws would be better if more time was given to their discussion.

MR. FIELDING—Suppose a session is approaching the end, the Commissioner may have his attention directed to something erroneous, then he would try and remedy it. At the end of last session we had many things to do which should have been done earlier in the session. When the Commissioner believes a mistake has been made he rushes in to make an amendment. Every member of the house has his undoubted right to bring forward any legislation with respect to mines, but to say that no legislation should be introduced without supervision as you suggest, is going too far. An opportunity should be afforded the Mining Society and gentlemen interested in mining to present their views, and to represent what is most desirable, but the Government cannot make it a positive and unbending rule.

The deputation having thanked the premier for his courteous hearing then retired.

AFTERNOON SESSION.

The members assembled at two o'clock, the President in the chair.

The first paper for consideration was:

EFFECT OF A LIGHTNING DISCHARGE AT THE SCOTT PIT.

By Charles Fergie, M. E., Westville, N. S.

The Scott pit shaft is 226 feet deep and down to the second seam, which is 12 feet thick, some 8 feet being worked. For some months past the only work done on this seam has been the driving of a pair of slopes to the deep to intersect the main seam by way of a tunnel already driven. These slopes are 2,000 feet down, and the driving of them was proceeded with until about the end of July last, when, in consequence of the colliery supply of water for steam purposes showing signs of giving out, they were stopped, and all work confined to the main slopes, the Scott pit being laid idle. Previous to this the mine had been ventilated by a Schiele fan but having no steam to spare, in consequence of the scarcity of water, the fan was stopped and the mine received its supply of air by natural ventilation only. The seam being a very gassy one this mode of ventilation would not be sufficient to keep the mine clear, but as no person was to enter the mine until the normal state of affairs was again restored, it was not anticipated that any danger from an explosion of gas could possibly occur. The air of the mine being highly charged with fire-damp, the necessary means of ignition were soon to be forthcoming. On the afternoon of the 8th August, about 4.50, there was an electric storm passing over the vicinity of the colliery, and which discharged itself. The general office was struck by

lightning and the front part of the building demolished. At the same time it struck the iron pulleys of the head-frame at the Scott pit and travelled down the steel winding rope entering the mine, and instantly igniting the gas accumulated therein which caused a severe explosion, the force of which demolished the buildings on the surface at the upcast, and at another shallow shaft called the "Stair pit." The writer, who was sitting writing by his office window, could not distinguish any lapse of time between the thunder clap and the explosion of the mine, so simultaneous were they. It being the opinion after the explosion that fire existed below, it was decided without delay, seeing that the ventilating shaft and fan were damaged, also the cages of the winding shaft, to seal up the mine, and this was done without mishap within about an hour and a half. The mine has since remained sealed and will likely be reopened about the end of October when the busy shipping season is over. The writer will then be in a better position to state the actual effects of the explosion underground and proposes to supplement this paper at a later date. Though having read of lightning have entered a mine by way of steel ropes, etc., the writer is not aware of any explosion having been directly traced to that cause before the one now referred to. This accident, and which was happily unattended by loss of life, clearly demonstrates that no mine where gas is allowed to accumulate to an explosive point can be considered safe from an explosion when it is connected with the surface by some conductors of electricity such as wire ropes, water pipes, steel rails, etc. It also serves to point out that where bore holes are put down from the surface for the purpose of rope haulage underground these holes and ropes should not pass through a return airway or where gas is likely at any time to be mixed with the air in high percentages.

DISCUSSION.

Mr. POOLE—That lightning can damage a pit has been spoken of, after the more conclusive case could be had, and the electric fluid finding its way into the recesses of a mine and causing an explosion of inflamable gas, has been on several occasions discussed, but I do not rember having read of any case that so conclusively proved that lightning had actually fired gases in a pit than the present one. No other alternative was possible, no one was below, no one was about the mine at the time, and simultaneously with the explosion, there was a violent electric discharge which injured the gable of a building some 200 feet distant. The earth tremor from the explosion was felt at Stellarton and caused those who noticed it to remark that they never before noticed thunder to shake the ground as did this particular report.

On several occasions lightning has been seen to run along the iron rails underground, and in some cases men have complained of being partially stunned. Mr. G. I. Burns in Vol. III, Part 4, of the Trans. Fed. Instit. M. E., 1892, mentions several cases where lightning was seen to enter coal mines in New Zealand, and a premature blast in the Hoosac tunnel which killed some sixteen men was imputed to lightning entering the tunnel by the battery wires.

The question came up before the Accidents in Mines Commission in 1880, and in answer to an enquiry from the Secretary of State, Messrs. Abel and Clifton wrote:

"The electrical excitement consequent upon the heavy storm which occurred at the time of the explosion as Risca would have had no effect 'in making gases more explosive,' in other words, the explosive properties of mixtures of fire-damp and air are not influenced by violent electrical excitement.

"Electrical means of signalling may be used in localities filled with explosive mixtures of gases with perfect safety, pro-

vided the battery employed will not produce a spark under any circumstances likely to occur in the working of the signals.

"There is no difficulty in obtaining batteries which are perfectly safe.

"We think it right to point out that it appears to us not impossible, considering the arrangements frequently existing in respect to metal guides, and to the wires used in the ordinary means of signalling, that during a violent storm a portion of an electrical discharge may find its way into workings and fulfil conditions necessary for the ignition of gas even at some distance from the pit's mouth."

MR. FERGIE—There is no doubt but that the explosion occurred through the lightning striking the winding rope and entering the mine. Simultaneous with the striking of the head-frame it struck the building. The conditions underground were favorable for an explosion—the slopes were full of gas.

MR. BAIRD—I thought I had an instance of the same kind in my mind, but I cannot recall it just now.

MR. FERGIE—You may not have the same conditions for an explosion in the mine during the next 500 years—that is for the lightning to strike that spot and have the air in the same condition—the air was at an explosive point.

MR. CLARKE—How would this affect the working of mines with electrical machinery?

MR. FERGIE—Where you have your ventilation up to an explosive point electrical machinery would affect; otherwise not.

MR. HARDMAN—At what point would the lightening probably leave the cable?—*i.e.* where was the flash underground?

MR. FERGIE—The cage was hanging at the end of the cable about 25 or 30 feet from the bottom and the discharge occurred at this point. It would be impure air right up to the cage from the bottom. It would be stagnant for about eight days.

MR. HARDMAN—So the flash would be at the bottom?

MR. FERGIE—Yes.

DR. GILPIN—There was a case on the continent where an explosion occurred which was attributed to lightning. There is a case where lightning entered a pit and traversed the workings but did not do any damage. It was about twelve years ago.

A vote of thanks, moved by Mr. Hardman, seconded by Mr. Clarke, was accorded to Mr. Fergie for his valuable paper, and was passed unanimously.

NOTES ON PRACTICAL MINING, APPLICABLE TO SOME GOLD MINING DISTRICTS IN NOVA SCOTIA.

BY MR. W. R. THOMAS, M.E., MONTAGUE, N.S.

In treating this subject I propose to evade the much discussed and debatable question, as to formation of the "belts" with the contained auriferous quarts "leads," as found in Nova Scotia; leaving the solving of this problem to far more able geologists than myself, as well as to men who have had far greater experience in gold mining generally.

I intend asking you to consider a few principles, which may be applied in conducting mining operations in some gold mining districts of Nova Scotia, practically taking my stand on experience in the Montague district, together with information gained from conversation with people engaged in other districts in the province.

I also desire you to look on the following as being the conclusions of one who has had but a comparatively short experience, not only in gold mining, but in gold mining in Nova Scotia. However, I must candidly state that I cannot concur with the opinion of some mining experts, when they speak of the absurdity of men, who have only previously had experience

in mining for other ores or metals, entering the profession of gold mining. I look on common sense and judgment as being the first and foremost principles which men in all the various branches comprising the mining profession should possess, and if possible, cultivate.

Surface Operations—In this, as well as in many other countries, some huge blunders have been made, not only in the erection of suitable machinery, but in the extent of the plant required. I venture to say that had the amount of money which has been unadvisedly expended in erecting extensive mining plants, been spent in mine development, the list of successful Nova Scotian mines would be much larger than at present. It is highly essential to have a sufficient quantity of machinery, enabling one to easily deal with the present output, but to commence the erection, on the laying out of a plant which the present developments do not warrant, looking a long way ahead in the dim future, is most certainly monstrous in its absurdity, and, in fact, a suicidal policy.

If a five stamp mill is of sufficient power to mill all the available quartz, why erect a 10 or 15 stamp mill? Or if a 30 h.p. engine is equal to working your pumping and hoisting machinery, is it economy to erect an engine of 80 or 100 h.p.

Naturally, when water power is within reasonable reach, it is wise to utilize it, assuming that after full consideration from a business point of view, the profit derived will be sufficient to warrant the necessary outlay.

Where this much coveted power is not within reach, procure the strongest, cheapest and most economical style of machinery, of sufficient power to cope with your present requirements, remembering that the less machinery you have the correspondingly less will be your account for supervision, fuel, rates and taxes, &c., &c.

One of, perhaps, my strongest reasons for conservatism on this point is, that it is especially discrete where actual mining is so expensive—surrounding rock hard, and "leads" small—to re-

duce the surface expenditure to a minimum. Of course this policy should be practised in all cases.

It is not possible to develop a mine in a day, week, month or even a year, as mining operations are not carried on as rapidly as one might bring himself to conceive when using the parallel ruler, scale and pencil. To "mine" in the rock and to "mine" on paper are slightly different in their natures; the results in many cases not comparing as favorably as one might desire, one with another.

I have not had any experience in importation of machinery in this province, but am of the opinion that the government of this country would, by the abolition of importation duties, create a confidence between themselves and foreign investors which, in the future, they might not regret. I say this not thinking disparagingly of the class of mining machinery locally manufactured, in fact I have pleasure at having an opportunity to state that, in my opinion, the machinery manufactured in this country is of a first-class order, and difficult to surpass; and I also feel assured that the local manufacturers are not afraid of competition.

Locating of Plant—It is also highly important in the laying out of a mine, that is the commencement of the necessary surface erections, to localise your plant as much as possible with a view to practising economy in the amount of labor employed in the supervision, &c.

In many countries, including Nova Scotia, economy in labor is an important matter, which should not be overlooked. I am personally acquainted with many instances where vast sums of money have been expended in the erection of mining machinery before even the most important considerations have been thought of. For instance, air compressing machinery on the top of a mountain, rendering the item, carriage of fuel, excessive, all of which might be saved by the purchase of 1,500 or 2,000 ft. of air pipes.

Underground Operations—We have all heard discussions as to the advisability of vertical shafts in preference to the in-

clined shaft sunk on the dip of the "lead." The former appear to me to be sure investments when large quantities of rock are being handled, but where, as in many districts in this province, the surrounding country rock is exceedingly hard and where practically small quantities of rock are being handled, I believe that the inclined shaft sunk on the dip of the vein, proving the portion of "lead" sunk through is the more advisable.

The consideration is whether the amount saved in hoisting by application of cages against skips, is sufficient to warrant the outlay necessary to sink a vertical shaft, which has, undoubtedly, to be classed as dead work.

When several "leads" are known to exist in close proximity, where the intention is to cross-cut and develop them all from one centre, and especially where these "leads" are practically uniform in quality, it would probably be advisable to sink a vertical shaft.

The more important consideration, that is the prospect of deep mining, will be dealt with at the conclusion of this paper, under pay streaks, their persistency in depth.

I believe that everyone will agree with me when I say that systematic mining—the developments carried on by means of drifts about 100 ft. apart which are connected by winzes—is far ahead of the method—sinking several shafts and carrying on underhand stoping at the same time—which has been applied in many cases in this province. Assuming that the former system be adopted, the next consideration is what method of stoping should be applied. This, I take it, is a matter in which the mine manager has to exercise his discretion and judgment.

I have seen some portions of ground in the Montague district where, in my opinion, by applying overhand stoping, one is likely to not only lose a portion of the quartz among the debris deposited on the scaffold, but lays himself open, in all probability, to losing the gold, especially heavy gold.

This most coveted metal is undoubtedly highly attractive in its appearance, and one gets so entranced by its sight, that he momentarily forgets who is the rightful owner.

Large quantities of rock can be handled more cheaply by the application of the overhand system, as shoots can be reared up with the stope, the intervening spaces being filled with debris.

I am a great believer in the application of the contract system in carrying on the developments of the mine. By doing so you employ the miner's brains, in addition to his manual labor. What interest can one expect the day's pay man will take in his work or in its result? Manipulation of labor is a very important factor in mine management.

A great deal more attention might be paid to cross-cutting, particularly at depths where the pay streaks are known to be continuous in richness. The application of rock-drilling machinery is essential for this work, as well as for the general development of a mine.

PAY STREAKS—THEIR PERSISTENCY IN DEPTH.—I look on this as being really the most important of all considerations relative to the future success of gold mining as an industry in this province.

When one looks around at the many gold districts and sees a large number of mines that were once successful, closed down, the first question that presents itself is: What is the reason why operations have been suspended? The usual local reply generally consisting of: Could not cope with the water, reckless management: had a barren streak for a few feet, and just before closing down, rich quartz was discovered right at the bottom of the deepest shaft; never should have stopped, etc.

It is, in fact, nearly impossible, according to local opinion, to find a mine that has been really closed down through barrenness. In nearly every country one hears the same, what should be termed, sentiment.

The next question, at what depth was the mine when operations were suspended, together with the reply, is something that requires consideration.

I have found, when making this enquiry, that the approximate depth of abandoned Nova Scotian mines is from 200 to 350 feet.

When one gets this information he naturally concludes this must surely be the depth where the pay streak discovered at the surface ceases to be continuous in richness. There is one argument which may be fairly raised against this conclusion, that is on account of the former primitive system of mining applied. The cost of pumping, hoisting, etc., was excessive, and as depth was attained the general working cost proportionately increased, until the streak which paid from the point discovered, to its present depth would no longer pay to work.

At present I am inclined to support the former conclusion, that is that the pay streaks become practically barren at a comparatively shallow depth—from 200 to 400 feet, but hope that this paper will be the means of creating a discussion which will enable the Society's members engaged in gold mining, to place on record their views, together with experience on this all-important subject.

As the extent of the mining machinery required for the working of our mines, depends very largely on this consideration, it is essential to know as far as possible the facts of the case, therefore, we, as a mining society, having the interest of the mining industry at heart, should openly discuss a matter of this kind, seeking to aid the industry by placing it on a sound and creditable basis.

The inference drawn at first sight appears to be decidedly derogatory to the gold mining industry.

Seeing that there are an innumerable quantity of unexplored quartz "leads," running parallel to those on which good pay streaks have been found, I am of the opinion that it would be more advisable to ask investors to place their capital for the exploiting of these "leads," rather than to work abandoned "leads" possessing a good record.

Some people may argue that in every probability there are other pay streaks which occur below those already worked, and if the mines were developed to a depth of, say 600 to 800 feet, these streaks should be discovered. Assuming this to be a

feasible theory, it would be a very difficult matter to secure capital with simply this object in view, as the development of Nova Scotian mines below 300 feet, through a hard and dense quartzite, is an expensive business.

If the government of the country takes any interest in their gold mining industry, and if those in charge of the Department of Mines, by making the necessary inquiries, and gathering together the requisite information, arrive at the conclusion that the prospects of deep mining are favorable, would it not be putting it in a practical form, if they—the government—were to offer a bonus as an encouragement or rather inducement to any investors attempting this form of speculation.

I am informed that the governments of Queensland and Victoria, on two or more occasions, voted sums of £1,000 and upwards, to promote the principle of deep mining together with other branches of industry closely allied to the same.

While on the subject, I would like to take this opportunity of calling attention to the mines inspection, as conducted by the representatives of the Department of Mines.

I have been engaged in mining in this province for nearly a year, and have never been officially called on, by either the inspector or deputy inspector, although, I believe, an inspection of the mine has recently been made by the deputy inspector.

I anxiously await the publication of the Mines Report, 1893, when the work will probably be particularized in the deputy's annual report.

Candidly, what good does the publication of small matters of this kind do? In fact, it surely assists in keeping capital out of the country; for what speculator would for one moment think of the importance of gold mining in Nova Scotia after reading the extract from the official Mines Report (1892), as published in the *Critic* of April 14?

There is undoubtedly plenty of room for imprevement in this direction. It appears to me that either the goveranment or its officials might plead—" We have done those things which we

ought not to have done, and we have left undone those things which we ought to have done."

I may state in conclusion, that many of the rich deposits of tin oxide in Cornwall were discovered at a great depth, and that districts, where this mineral is found practically near the surface are looked on as shallow districts, where the chances of deep mining are not as favorable as in the former districts.

I make this statement, with a view of calling attention to the many large quartz "leads" existing in the province, which on account of their not showing gold at their outcrop, have been apparently passed by as worthless.

DISCUSSION.

MR. HARDMAN—This Society is much indebted to Mr. Thomas for his valuable paper. I want to endorse Mr. Thomas' conclusions in almost every respect, but at the present time I cannot agree with his conclusions in regard to pay streaks. It may be true, and it may not be true, and the following case may be the "exception proving the rule": Last week in Oldham on the Standard Company's property at a depth of 520 feet we got the top of our pay streak. I simply state the fact that on one lead, at any rate, the pay streak has been cut at 520 feet depth on the incline.

MR. POOLE—At about what angle of inclination?

MR. HARDMAN—At 43 degrees.

MR. POOLE—The Wellington was on an angle of that inclination, was it not?

MR. HARDMAN—The Wellington was sunk 300 feet on the incline of 45 degrees, then the pay chute was followed for 300 feet to the westward at a dip of 35 degrees. The length of the winding rope was 600 feet, but the depth on the incline was 500.

MR. WOODHOUSE—I would like to ask any gentleman present who has been looking up the theory of pay streaks and taking vertical depths, whether he has found gold 400 feet below the surface?

MR. POOLE—How deep is the Salmon River mine?

MR. STUART—300 feet.

MR. HARDMAN—Taking our 520 feet on the incline would make about 340 feet vertical.

MR. WOODHOUSE—I think Mr. Thomas can give us some pretty valuable advice on this point. He is down about 300 feet. One of the deepest points in Montague was on the Rose lead, worked by Mr. Lawson—at one place it is 345 feet and the other 380 feet.

MR. THOMAS—The Rose lead is 365 feet, and the other lead worked was cut off by a dislocation.

MR. WOODHOUSE—Was that 365 feet vertical?

MR. THOMAS—Pretty nearly vertical.

MR. HARDMAN—In this particular chute I have reference to it is as one continuous streak for nearly 1,700 feet in length, and will extend to probably 2,000 feet.

MR. THOMAS—We had a streak at Montague. I drove a level at 264 feet from the surface and found that throughout the streak was fairly profitable for every 100 feet. With regard to the "Lawson" streaks—I think they were the result of intersections—so I would gather from the map and from information received from miners living in the district.

MR. HARDMAN—That lode would be similar to the streak found in Oldham in 1877 by T. N. Baker. It was made by intersections of angling veins with the main lode—the angle of dip of lode would be 60 degrees.

MR. THOMAS—What would be the law of streaks in the Windsor Junction property at Waverley?

MR. HARDMAN—I do not think there are any facts recorded to show any law. The shaft is nearly down to 400 feet on the Tudor lode. I have been told the inclination of the streak is 35 degrees to the east—but so far as our own workings went we failed to discover any streak whatever.

MR. HAYWARD—On the Lake View property—Dominion lead—the streak extended from the surface and was cut off by a break at 360 feet on the incline.

MR. WOODHOUSE—I would like to know the reason why some of the mines have been closed down—I would mention the "Rose" for example, also the "Lawson." I would like to know the reason for closing down these mines. Perhaps the pumps did not compete with the water—or perhaps they did not wish to make any more money.

MR. STUART—I think I know something about the "Lawson." I was the last man who worked it. I had had just such favorable reports as that made to me—"It is as good at the bottom as any part of the old workings." Mr. Lawson told me the last was poor and had not paid for several months. But my object in pumping out the mine was to drive some cross-cuts in what I call the "side lead." I think that side lead had something to do with the richness of the Lawson mine, yet it did not make the streak entirely, nor was there any regular gold streak. The gold was more in pockets and not in line. They were at different parts of the whole workings, not continuous but distributed over the whole ground that was worked, but the quartz taken out between these workings was not barren. At 360 feet it was pinched to about two inches and only gave me two pennyweights to the ton, but in the western end where the lead was larger, it gave from 15 to 20 pennyweights, but the pay ground was short. The plan kept by Mr. Lawson showed conclusively that there was no regular pay streak. He crushed by contract for each crew of men separately each month, and indicated on his plan the exact amount of quartz taken out of each portion of the ground, and the exact amount of gold obtained.

MR. WOODHOUSE—A copy of that plan is in the Mines Office, is it not?

MR. STUART—I think it is.

MR. POOLE—I think it is published in the report of 1876.

MR. STUART—I quite agree with Mr. Thomas in regard to the various reports of the mines which shut down, and that it would be well to compel mine owners to keep a plan on file in the Mines Office when the mine is shut down; it would prevent a great deal of toil.

MR. CLARKE—Is there not a provision to that effect now?

MR. STUART—It occurs to me that there is something to that effect?

DR. GILPIN—That point has been talked of for some time and my idea was to have a man make it his business to go and get that information and put it on a plan, so that it would be placed on record.

MR. STUART—Would it be too much to have that attached to the inspector's duty.

DR. GILPIN—I am afraid it would. At first it would take a great deal of work to get the thing up; after that not so much.

MR. POOLE—Appoint another officer.

DR. GILPIN—There was an amendment put in the Act by James A. Fraser to that effect. To do that would simply mean another officer. Now that the royalty is getting better it has come up again.

MR. STUART—I think it would not be too much to make it obligatory on the mine owner.

MR. THOMAS—In the west of England all mine owners are bound to keep plans and data up to date, and when the inspector comes on his round he sees that the work is done.

GOVERNMENT AID TO MINING—A SUGGESTION?

MR. JOHN HARDMAN—The title of my remarks as printed by the Secretary is "Government Aid to the Mining Industry—A Suggestion?" I was careful to have at the end "A Suggestion," and I beg that it be kept in mind, but from the interview of our committee with the Premier this morning, and from the discussion on Mr. Thomas' paper this afternoon, it is quite evident that the suggestion is an opportune one. As a government function we would have good precedents for the government's undertaking to give aid to the mining industry. I notice that Mr. Thomas in his paper speaks of the sum of £1000 being voted in Victoria. In the fiscal year of 1886 the government of New Zealand spent over $50,000 in water races, nearly $150,000 in roads, and over $180,000 in actual construction or subsidizing of other works and for the purposes of deep mining and of furthering the interests of mining generally. The total amount appropriated for gold fields alone in that year being nearly $400,000.

The Spanish Government recently spent over $200,000, for a new building for a mining school in Lisbon, and in New South Wales they are spending large sums every year—£40,000 I believe. So that we have very good precedents when we go to the government of this country and ask them to help to forward the mining industry. I am now speaking particularly as a gold miner, but I do not see why the idea should not be equally serviceable and valuable to other kinds of mining. At the outset the question arises if the Government is to extend aid to mining, is it to the Provincial, or to the Dominion Government we should apply? I think it will be remembered by some here that in the year 1881, the Provincial and the Dominion united in having surveys made of Lawrencetown and one or two other districts, and they contemplated making surveys of more districts, but the work was discontinued because it was found to be too expensive.

It seems to me that we have no claim on the Dominion Government in this matter, as all the royalties are payable to the provincial treasury, and I do not see, therefore, any reason why the Provincial Government should not bear all the expenses. There have been some previous efforts in this line of asking Government help; propositions were made as far back as 1887. Mr. Thomas suggests in his paper that the Government should give a bonus. I think the original form in which Government aid was asked was that the Government should sink a test shaft in such a place as should be desirable in order that the existence of workable veins at great depths might be proved. But a difficulty arose at once; in which district should this shaft be sunk? Each district could put forward claims that would make a decision difficult, if not impossible, and this proved a fatal objection.

The next suggestion was that the first man who put his shaft down to 1,000 feet should receive a bonus of $10,000 or like sum. But there were certain valid objections raised to this proposition. A shaft sunk in Montague might not tell us about the strata in Renfrew, or Wine Harbor, or any of the other districts. Again it was suggested by the late John Kelly, that the Government should remit the royalty on all gold coming from certain depths. Gold from below 500 feet to 1,000 feet should pay a royalty of only 1 per cent, and from below 1,000 feet should be free of royalty, in other words, the amount involved was a bagatelle and not worth considering.

And more recently still the suggestion has been made that the government should purchase a diamond drill, and bore from 3 to 4 holes in each district, to test the existence or otherwise of workable veins. All of you here know that a bore hole might go down within 12 or 13 feet of a pay streak and yet the core show poor ground, the drill again may go through a pinched portion and fail to indicate any quartz lode at all.

In spite of the failure of these several schemes to materialize, yet it is highly desirable that the Government should extend such aid and help to the gold industry as would tend to advance

the output and increase the knowledge we now possess of the resources of the industry. Therefore, I venture to bring forward at this time an idea which has been gradually taking shape with me, and which I believe would be of permanent value and material benefit to the whole metallic mining interests of the province, and especially to gold mines.

I suggest the construction of detailed topographical maps of each prominent district, accompanied by a monograph in pamphlet form, which shall explain the map and give fuller letter-press descriptions than the scale of the map may allow.

The details yet remain to be worked out, but the salient points, I may describe as follows:—

The map, constructed on a scale of *not less* than 200 feet to the inch, and preferably 100 feet to the inch, would show—first, the area lines, distinctly and clearly indicated by a faint green line, the area numbers being also printed in the same color: secondly, the roads, in a brown shade; thirdly, all known and located lines of faults or breaks by a conventional dotted or broken black line; fourthly, the out-crops, or worked portions of the outcrops, of all discovered veins by red lines; fifthly, all streams, swamps and wet ground in blue lines, tints or hatching; sixthly, showing contour lines, either 10 or 20 feet apart, over the district, in continuous faint black lines.

In addition, the location of each shaft or incline, over 20 feet in depth, should be noted and the position of buildings of a permanent nature, as mills and steam hoists, etc., should be marked.

By a system of letters, with corresponding references in the margin, a great deal of information could be placed in small compass, directly on the map sheet, which should, of course, be detachable from the pamphlet for convenience of reference.

To simplify matters and explain the scheme to you much more graphically than I can talk, I have prepared a map of a portion of the Oldham district, showing about 27 areas out of some 500. I may say here, that the intention is to confine the map closely to the limits within which gold bearing lodes have

been found, and not to extend the map beyond the worked limits of any district. I regret that the time at my disposal has not permitted me to put the contour lines upon this sketch of Oldham district, but I am sure that you will agree with me that they should be an essential part of the map.

The monograph accompanying each map could be made up largely from the provincial records, and the reports of the Dominion Geological Survey, supplemented by information obtained during the actual mapping of each district. This monograph should contain, amongst other things, a full official record for each year of the amounts raised and milled and the yield therefrom; descriptions of the more important veins and their workings; the peculiarities, mineralogical and lithological, of the district; sections of the district at important points, and simple line drawings of the underground workings of the chief producing lodes. Also such other available information, technical, economic and geological, as would help to make a complete history of each district to date.

Doubtless one of the first questions I shall be asked is: "What will it cost?" To this I am prepared to give an answer. I have consulted Mr. Faribault, of the Dominion Survey, on this matter, and have availed myself of his experience and advice. Primarily, there are but thirteen or fourteen districts which I would map as suggested; I would say that a district which has not produced a minimum of 5,000 ozs. since discovery, was not important enough for this map. Starting, therefore, with 15 districts, the cost of fieldwork, plotting, compiling, printing and lithographing, should not exceed $20,000. Some districts will cost more than others, for example: Sherbrooke and Waverley, the two largest and greatest producing districts, would probably cost $2,000 each, while Wine Harbor and Oldham would not cost over $1,000 each.

Much of the work could be done cheaply. A provincial land surveyor with assistant could go over the ground first, laying out area lines, marking each corner with small temporary

stakes, and at each tenth stake putting in a more permanent monument; after him let two men come on with a level—engineering students from Dalhousie or McGill, who would be glad of the experience in the field—and run the contours. Finally, let the chief, or geologist, come last with one good assistant; marking on the map as plotted by the two corps preceding him, the various veins, faults, etc., etc., as I have already mentioned, and collecting and arranging the large mass of valuable matter now solely recorded in the heads of the older local residents whose ranks time is steadily thinning.

From two to four, or an average of three, of these maps and monographs could be completed each year, putting on the provincial treasury a strain of not over $4,000 to $5,000 per year. After these maps are once published it is only a matter of local statutory regulation to have them kept up to date by the Mines Office.

I do not believe that there is a gold mining corporation or firm represented in this room but would have saved thousands of dollars in preliminary exploitation work had such maps as are proposed been available to him before he began work.

I may go further and say that I do not believe the Province of Nova Scotia can better advertise her resources abroad than by the dissemination of such maps and documents. It appears to me to be a case of killing two birds with one stone, advertising her mineral resources, and substantially helping the mining industry at the same time.

And I close by urging upon you the necessity of preserving in some form the data we now have in the memories of the older miners. Twenty years from now they will all be dead, and information gained will be at second hand.

DR. GILPIN—There is no doubt about it, now is the time to do this thing. In respect to the remarks of Mr. Hardmans about the survey made by Mr. Dawson—the facts were that an agreement was reached between the Dominion Government and the Local Government in 1880 that they would join in

bearing the expense of a topographical survey of the gold district starting from Halifax and extending eastward. This was projected in order to facilitate and expedite the work of the Geological Survey which was working from the east to the west on the Atlantic coast, so that whenever he struck the ground which had been previously surveyed he could get through his work more quickly. The amount of expense was considered too great, and the survey stopped at the end of the first season. The plan of the work of Mr. Dawson became the property of the local government and has been in frequent demand and proved very useful for many purposes connected with surveys and location of waterworks, etc., and has undoubtedly saved expenditures in surveys, and paid for itself many times over.

A vote of thanks was unanimously accorded Mr. Hardman for his valuable remarks.

MEMBERS DINE TOGETHER.

Promptly at eight o'clock the members, to the number of thirty, filed into the St. Julian dining room and sat down to an excellent dinner served by the proprietors of the Halifax Hotel. Mr. H. S. Poole, President of the Society, occupied the chair. Among the other guests present were the Hon. W. S. Fielding, Premier of Nova Scotia, and Mr. S. P. Franchot, Vice-President of the General Mining Association of the Province of Quebec. Ample justice having been done to a generous bill of fare, a number of toasts were given, the speakers of the evening being Premier Fielding, Mr. John F. Stairs, M.P., Mr. Arthur Drysdale, Mr. R. H. Brown, Mr. James Baird and Mr. S. P. Franchot. The proceedings were enlivened by a programme of songs and choruses to which Mr. G. J. Partington, W. R. Thomas, Alfred Woodhouse, B. T. A. Bell and others contributed, Mr. Ernie Wyld officiating with much acceptance at the piano. Considerable diversion was

caused by the droll and humorous selections most effectively delivered by Mr. Frederick Taylor, of Lowell, Mass. The proceedings, which were of a most enjoyable character, terminated shortly after midnight.

EXCURSION TO THE MONTAGUE AND WAVERLEY GOLD DISTRICTS.

On Friday morning a number of the members drove out in a four-in-hand to the Montague and Waverley gold mines where an interesting time was spent at the properties of the Symon-Kay Syndicate, the Nova Scotia Gold Mines (Ltd.), and the West Waverley Gold Co. (Ltd.) An inspection was also made of the work in the Laidlaw's Hill tunnel at Waverley. An excellent luncheon was served at Beech's Hotel. Notwithstanding the wet weather which prevailed, the members greatly enjoyed the drive and the outing at the mines, and each and all returned to town with a keen appreciation of the many courtesies that had been extended to them by Messrs. Hardman, Wilson, Thomas and Woodhouse.

TIBERG'S MAGNETIC INCLINATION SCALE.

By Ernst A. Sjostedt, E. M., Bridgeville, N. S.

Until recently only the miner's compass and Professor Thalén's magnetometer have been used for magnetic explorations in the field. The use of the compass is simple and convenient, but not sufficiently accurate for any detail work, and the magnetometer, although accurate, is rather tedious for practical purposes.

A simplified, and at the same time reliable method for the work in question was proposed, some years ago, by E. Tiberg, of Sweden; and the instruments used and constructed by him are: 1st, a so-called magnetic inclination scale; 2nd, a plane-table; and 3rd, an alidade instrument.

The inclination scale consists, externally, of a round box of 80 m/m diameter, and 15 m/m depth, placed between two quadrangular brass frames of 90 m/m sides. At its circumference it has a graduated circle, and in the centre a magnetic needle of 60 m/m length, supported so as to be free to move vertically as well as horizontally; consequently it is a kind of inclinatorium. It differs from the usual construction, however, by the centre of gravity of the needle being somewhat below the axis of support when the instrument is placed in its vertical position, and also by the needle being compensated for the vertical component of the terrestrial magnetism, by a piece of wax being fastened on the S end of the needle. The instrument is provided with a spirit-level for its horizontal adjustment, and has a handle by which it can be suspended vertically. The needle is encased and covered with a glass lid.

The plane-table is provided with ball and socket-joint, by which means it is moveable around its vertical axis, and can easily be levelled by a slight pressure on the same.

The alidade instrument is a brass plate about a foot long, in one end provided with four flanges placed in a square for receiving the scale, and at right angles to this square there is a slot running along the centre of the plate, in which moves a socket, intended for holding the magnet used when surveying underground. It also has two pairs of folding sights, with one long and one short sight-vane, and so arranged that their sight-lines are at right angles to each other, in consequence of which the instrument can be used as a cross-staff, as well as an alidade. The long sights are graduated for taking angles of elevation, having the zero marked lowest down, and the graduations so made that each degree corresponds to 1% of the distance between the sights. This instrument is also provided with a spirit-bubble.

The magnetic surveys performed with the inclination scale are of two kinds: 1st, the "vertical survey," when wishing to determine the vertical force of the magnetism in a survey above ground; and 2nd, the "horizontal survey," when wishing to determine the horizontal force of the magnetism—principally when surveying underground.

I. Survey above Ground.

When about making a survey above ground, the inclination scale is first adjusted (*i. e.*, the needle compensated for the vertical component of the local terrestrial magnetism) and a magnetic reconnoitre map is roughly made out, showing the direction and distribution of the ore. The field is now divided up into squares, generally of 40 feet sides, pains being taken to place the base lines as near as possible in the centre of the magnetic field, and parallel with the strike of the vein.

The section points on the base are marked with stakes or stones. The observations with the inclination scales can now be made with or without the aid of the plane-table. When using the table, the scale is laid on it, so that the edge of the frame, which is marked N or S, is close up against two small brass pins fastened in the table. The plane-table is now levelled (by the

aid of the spirit level on the scale), and then turned until the needle points at 90°. The scale is now raised by the handle, and the lower end of the frame moved up against the pins, *i.e.*, the instrument placed at right angles to the local magnetic meridian. Without the plane-table this angle can be approximately determined by holding the scale by the handle and allowing the instrument to hang free, at right angles to the magnetic meridian. An error of 5° in this plane does not generally signify much, but when the ore is looked for at a considerable depth, and when the horizontal intensity is strong (which is indicated by a lively motion of the needle in the horizontal plane), the table should be used, especially for determining the max. values.

The results obtained are marked in the proper places on the cross-section paper, the ruling of which corresponds to the divisions on the field, and equal results combined, so as to form lines, each of which, thus, indicate an equal vertical magnetic intensity.

A sufficient number of observation points for marking these lines accurately on the map while surveying should be taken, which often necessitates observations being taken between the cross lines, especially in the immediate vicinity of the ore, say every 5 or 10 ft. on the cross lines, off from the base line. Besides the obtained results, such as remarks the presence and influence of iron, ore, and or ore dumps, etc., should be noted, and their positions shown on the map. Contour lines of the field are also platted (in event of the ground being undulating) with the aid of the alidade instrument. The difference in the level between two points A and B, the horizontal distance between which is known, is readily determined in the following manner:—Put the the plane-table, with the alidade instrument at A, levelling the same. Place at B a pole of the same length as the height of the instrument above ground, and sight to the top of the pole, from one sight of the alidade to the opposite one, and read off the number of degrees thus obtained. The number multiplied by the

known horizontal distance between A and B, and divided by 100 gives the difference of level sought. Thus, by following the base line and sighting to the fixed points (poles) on this line, as well as to the numbered sticks on the cross lines, the levels can easily be read and marked down on the map, as the distance between the above points are known, and the calculations simple. The more important features of the topography of the field should also be platted on the map, so that the fixed points on the base line can easily be found when, subsequently, we are trying to find the ore lead designated on the map.

The direction of the terestrial magnetic meridian is observed on magnetically neutral ground, near the ore field, and this will be the north line of the map.

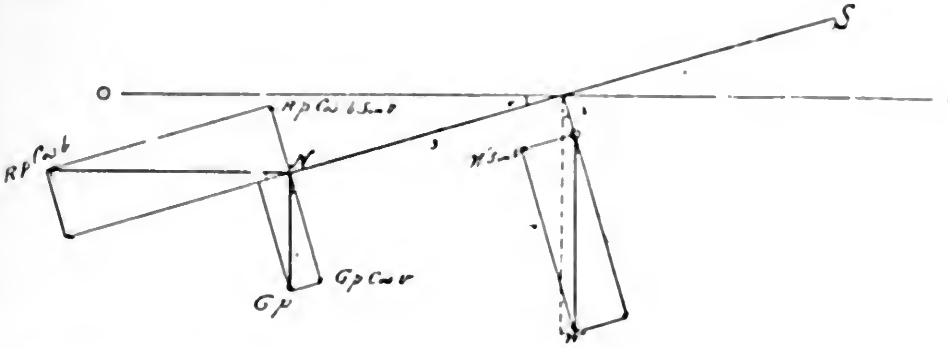
The magnetic maps thus obtained should be colored, using different tints for the different intensities, blue being used for the positive, and red for the negative intensity.

Among the sources of error met with in a magnetic survey, the following should especially be guarded against: Changes of temperature and humidity of the atmosphere, windy weather, and the presence of objects of iron, ore, piles, etc. The latter cause an added northerly attraction above them, and a southerly attraction on the sides. A large wire rope, for instance, at 25 ft. above ground is sufficient to cause a deviation of 6° to 10° on a sensitive instrument.

Calculations.

1. For calculating the *vertical intensity* of the magnetic force, we will first deduce a general formula for the value of the angle obtained by the magnetic needle, when the inclination scale is placed vertically, independent of its position in the horizontal plane. Let us then suppose that the needle is compensated for the vertical force of the terrestrial magnetism (its influence, therefore, not to be taken into consideration) and that the observation is made in a magnetic field, where the N end of the needle gives a positive angle, *i.e.*, is attracted downwards.

Supposing also that the instrument is not in the plane of the magnetic meridian, and that



b = the angle between the meridian plane and the vertical plane through the longitudinal axis of the needle.

v = the inclination angle of the needle, *i.e.*, the deviation from its horizontal position.

G = the local vertical magnetic intensity, the terrestrial magnetism excepted.

R = the resultant horizontal magnetic intensity at the place of observation. The force with which R attracts the needle in its vertical plane is therefore R Cos b.

W = the weight of the needle, not counting the counter weight.

r = the distance between the axis and the centre of gravity of the needle.

p = the total magnetic force of the needle, which for convenience sake is supposed to be concentrated at one point in the N end of the needle, and

s = the distance from its axis.

m = the magnetic momentum $= ps$.

The forces influencing the needle are shown in the above diagram. The equation of equilibrium will be:

$$Gp \operatorname{Cos} v\, s = Rp \operatorname{Cos} b \operatorname{Sin} v\, s + W \operatorname{Sin} v\, r$$

$$ps = m \qquad Gm \operatorname{Cos} v = R \operatorname{Cos} b \operatorname{Sin} v\, m + W \operatorname{Sin} v\, r$$

$$G = \frac{R \operatorname{Cos} b \operatorname{Sin} v\, m}{m \operatorname{Cos} v} + \frac{W \operatorname{Sin} v\, r}{m \operatorname{Cos} v}$$

$$G = \left(R \operatorname{Cos} b + \frac{Wr}{m}\right) \operatorname{Tan} v \ldots\ldots\ldots\ldots (1)$$

$\frac{Wr}{m} = K =$ a Constant.

$$G = (R \text{ Cos } b + K) \text{ Tan } v \ldots\ldots\ldots\ldots (2)$$

and if $b = 90°$, as in the vertical survey described, then the vertical intensity

$$G = K \text{ Tan } v \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The lines combining equal values of v on the maps, therefore, also form the lines for the vertical intensity.

For determining the constant K, magnetically neutral ground is sought. After the plane-table has been set up, a strong magnet is suspended under and at least 70 c/m from the same, with its N end turned upwards; the table is levelled, the magnetic meridian directly above the magnet is observed, and here two observations are made, one with the instrument placed at right angles to the magnetic meridian, the other with the instrument in said meridian, and in such a way that $b = 180°$.

u = the angle obtained in the first instance,
w = " " " latter "

If these values are substituted in the formula (2), and as Cos $b = 0$ and 1 respectively, then

$$G = K \text{ Tan } u = (K - R) \text{ Tan } w \ldots\ldots\ldots (4)$$
$$K (\text{Tan } w - \text{Tan } u) = R \text{ Tan } w \ldots\ldots\ldots (5)$$

Here R = the horizontal component of the terrestrial magnetism which we will call H, thus

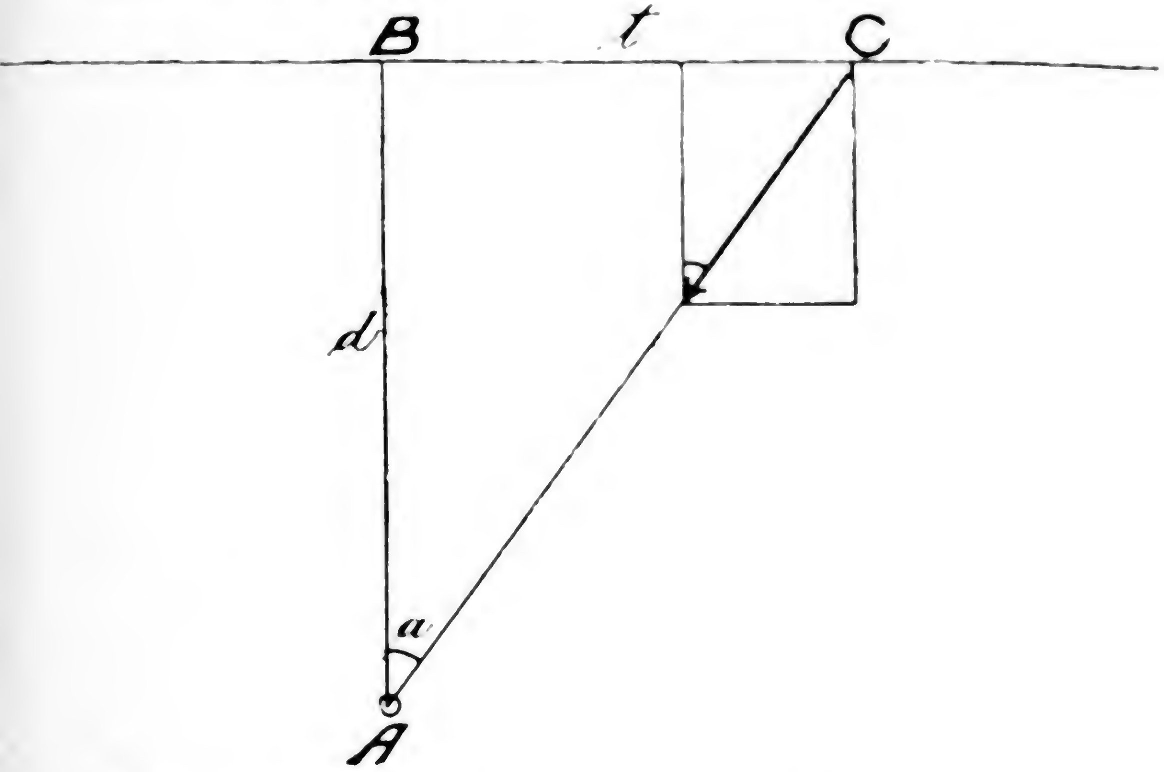
$$K = \frac{\text{Tan } u}{\text{Tan } w - \text{Tan } u} H \ldots\ldots\ldots\ldots\ldots (6)$$

w can be larger or smaller than 90°.
When w is larger, equal with or smaller than 90°, then K is, respectively, smaller, equal with, or larger than H.

2. The *horizontal intensity* is easily deducted from formula (5):

$$R = K \frac{\text{Tan } w}{\text{Tan } w} - \frac{\text{Tan } u}{\text{Tan } w} = K \left(1 - \frac{\text{Tan } u}{\text{Tan } w}\right)$$
$$R = K (1 - \text{Tan } u \text{ Cot } w) \ldots\ldots\ldots\ldots\ldots (7)$$

3. In calculating the *vertical distance from the surface to the upper pole of a vertical ore deposit* we will make the supposition that the whole of the magnetic force in the upper part of the ore, the north pole, is concentrated in one point A, and that the S pole is so far distant that it does not effect the relative value of the results in those parts of the observation plane nearest to the ore.



Two observations should here be made, one direct above the pole A (at B, which point is indicated by a maximum value of the inclination angle), and another somewhere in the neighborhood (at C).

d = the vertical distance from the observation plane to the pole A.

a = the angle $B\ A\ C$.

$V_{max.}$ = the angle obtained at B.

V_1 = " " C.

G max. = the vertical intensity at B.

G_1 = " " C.

P = the magnetic force at the ore pole at a distance 1 from the same.

According to (3) the magnetic intensity at B is

$$G \text{ max.} = \frac{P}{d^2} = K \text{ Tan } v_{max} \ldots\ldots\ldots\ldots\ldots (8)$$

The magnetic force at C is $\dfrac{P}{\left(\dfrac{d^2}{\text{Cos } a}\right)^2} = \dfrac{P \text{ Cos}^2 a}{d^2}$

and its vertical component $G_1 = \dfrac{P \text{ Cos}^3 a}{d^2} = K \text{ Tan } u \ldots\ldots (9)$

From (8) and (9) we obtain

$$\frac{P}{d^2 K} = \text{Tan } v_{max.} = \frac{\text{Tan } u}{\text{Cos}^3 a}$$

and

$$\text{Cos}^3 a = \frac{\text{Tan } u}{\text{Tan } v_{max.}} = \text{Tan } u \text{ Cot } v_{max.} \ldots\ldots (10)$$

also is

$$d = t \text{ Cot } a \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

If the first part of (9) $\dfrac{P}{d^2} = k$

then

$$G = k \text{ Cos}^3 a \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

and if F=the horizontal intensity of the ore magnetism at C, then

$$F = \frac{P}{d^2} \text{ Cos } a \text{ Sin } a$$

or when $\dfrac{P}{d^2} = k$

$$F = k \text{ Cos}^2 a \text{ Sin } a \ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Viewed generally the magnetic maps indicate the distribution of the ore deposits in the field, and the direction of the strike. They also give reason for many detail studies, among which the principal ones will here be mentioned.

A max. of the magnetic intensity signifies that the ore rises or crops out at this place.

The extent of an ore deposit is approximately indicated by the longitudinal diameter of the curves nearest surrounding the max. value. The distance to the centre of a single vertical ore deposit, which is deep below the surface in proportion to its own

depth, can be considered to be at least 0.7 of half the width of the northerly polar attraction. This rule, however, is not always applicable, owing to the many conditions it pre-supposes.

The character of the intensity curves gives a general idea of the ore deposit, viz., regular, oblong and elliptic curves, surrounding a long but narrow max. curve, or circular curves with their max. confined to a small pace, indicate a regular ore lens; whereas irregular curves with wide and nearly circular max. fields, inside of which the intensity but slightly changes, point at irregularities in the ore deposit.

Should an unsymmetrical expansion of otherwise regular curves appear on one side or another of the main ore, this, as a rule, depends on the presence of a parallel ore lens.

A negative intensity value (that is a southerly polar attraction) has many different indications and should be closely studied. It may be obtained when the ore dips, in which case the ore nearest the foot-wall will give a more or less decided southerly polar attraction. If the dip is nearly vertical, the negative attraction and the min. intensity is considerably pushed beyond the lower ore pole; and if the dip is approaching the horizontal plane, the southerly polar attraction is partly spread over the lower end of the ore, whereby also the min. will be found close to the point just above the south pole. In most cases the southeriy polar attraction can be attributed to the ore deposit being several times longer than its depth, and its strike being north and south. Many have but slight extent, and as a rule these indicate small but extended ore lenses. Southerly polar attractions of this kind often occur at the north end of the ore field, in which case the ore is continuous for a long distance, and their width is also frequently very great—sometimes up to thousands of feet. It sometimes happens that the northerly polar attractions cover all the upper part of the ore up to its northerly end, whereas an extensive southerly polar attraction stretches north of as well as beyond the sides of the ore. This would indicate a relatively deep-lying ore. It is evident that a large magnetic ore deposit

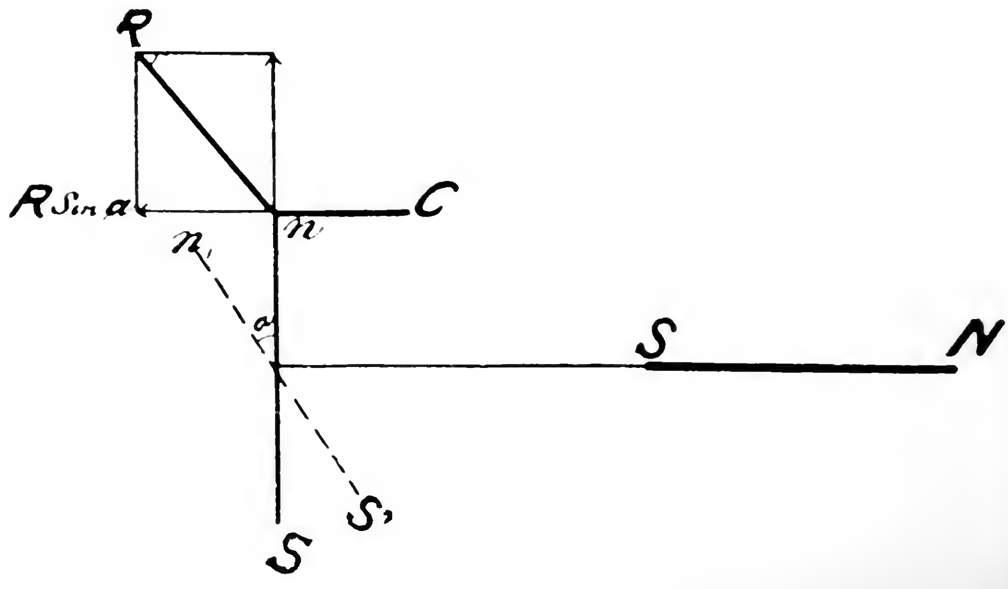
can *induce* magnetism in a smaller one; but a southerly polar attraction of this character is seldom met with, whereas two opposite poles, if close together, can considerably strengthen one another, as for instance when an extensive ore lens is cut off by a small vein.

Finally we may allude to the negative attraction often observed on the side of large ore dumps. The cause of this, as well as the northerly polar attraction above an ore dump, is that the ore pieces completely or partially act as soft iron, influenced by an inducing magnetic force, *i.e.*, every piece of ore behaves like a vertical bar of iron, around which the two kinds of vertical intensities are arranged.

II. Survey below Ground.

For determining the presence of any magnetic ore in the neighborhood of drifts, etc., underground, its horizontal magnetic intensity is calculated according to the preceding formula (7), or the following *modus operandi* is adopted:—

The alidade instrument is placed on the plane-table, which is levelled, and the inclination scale put in its proper place between the flanges, so that the diameter drawn through the zero points stands at right-angles to the slit for the auxiliary magnet. The magnet is then placed in a certain fixed position in its track, the instrument is turned so that the needle points at 0°, *i.e.*, stands at right-angles to the magnet. The magnet is removed and the angle of the needle read.



Let $N\ S$ represent the magnet.

$n\ s$ = the position of the magnet before the reading.

$n_,\ s_,$ = the magnet after the reading.

a = the angle obtained.

R = the resultant horizontal magnetic force at the place of observation.

C = the force of attraction on the needle by the magnet at its present fixed position.

$$C = R \operatorname{Sin} a \quad \ldots\ldots (15)$$

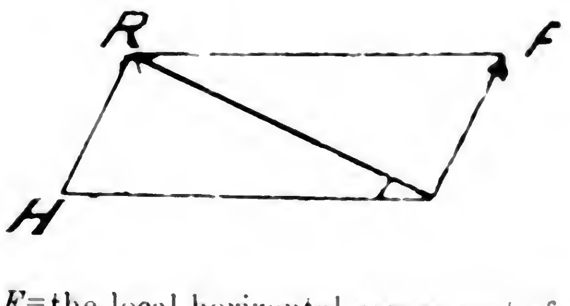
And if the observations are made in magnetically neutral ground, *i.e.*, in a place where no local magnetic forces exist, then $R = H$ = the horizontal component of the terrestrial magnetism at this place.

$$C = H \operatorname{Sin} a_{\circ} \quad \ldots\ldots (16)$$

where $a_{\circ}$ = the neutral angle (the angle obtained in this case).

If now an observation is made on magnetic ground, we then obtain from (15) and (16):

$$R = H \frac{\operatorname{Sin} a_{\circ}}{\operatorname{Sin} a} \quad \ldots\ldots (17)$$



Finally if F = the local horizontal component of the magnetic force; with the aid of the alidade instrument and the inclination scale, the direction of the terrestrial meridian in the locality is determined, also the direction of R, which platt on the map. In the parallelogram of forces, where H and F are components, and R the resultant, H and R are known quantities, F can graphically be determined to value and direction.

Preliminary to the magnetic survey under ground the neutral angle $a_{\circ}$ should be determined (*i.e.*, the position of the magnet in the track of the alidade), as well as the direction of

the terrestrial meridian, which should be properly platted on the maps.

The angle $a_{\circ}$ should be chosen rather small, say about 25°, or even less. It is evident, namely, that no other horizontal magnetic force can be determined in the manner aforesaid, than those larger than the constant C (Plate III), which, according to (16), will grow smaller with a decreased $a_{\circ}$.

If, once for all, the value $a_{\circ}$ be chosen, and the magnet adjusted accordingly, a table can be made for future calculations, showing the value of $\frac{\text{Sin}\ a_{\circ}}{\text{Sin}\ a}$ for all whole degrees of a.

If, now, a magnetic survey is about to be made in a drift, a base line is chosen with division points at least every 10 feet, at each of which three observations are made: 1st, the direction of the total horizontal intensity (R), and the deviation of the needle from the base line; 2nd, the value of said horizontal intensity (by determining a by use of the fixed magnet); 3rd, the vertical intensity.

For determining if the ore pole is situated above or below the drift level two other observations should be made (by hand), one a little above the table, and one about a foot above the bottom of the drift.

In plotting the maps, the position of the drift is sketched out on a good sized scale, the base line and the observation points marked, and the approximate direction of the horizontal intensity, and the value of the respective angles obtained at each place designated.

R and H are calculated, and H chosen as a unit for a suitable scale.

The parallelogram of forces is then constructed, and the magnetic horizontal components of the ore body determined to direction and value. The vertical intensity should also be marked.

If, now, all or most of the arrows thus obtained are pointed towards a common focus, and those arrows are the largest, which

are nearest to this point, and besides the vertical intensity is negative, there is reason to believe that ore is here to be found. According as the arrows meet forward, (towards the point), or backwards, the plane of observation is respectively above or below the magnetic centre.

If the vertical intensity be positive, the ore can be considered as located over or below the level of the observation plane.

Should there be a large known ore lense near the drift in question, it is evident that a survey of this kind would often be of no value as regards discovering a new ore body. The same would be the case if the ore looked for should happen to have its magnetic centrum on the exact level of the places of observation, but in this case the vertical survey would give reason for continuing the trial work. If, therefore, it can be seen that the horizontal survey in many instances cannot give any practical results, yet there are many other cases where they will be met with decided success.

The above notes are extracts from a very carefully prepared and exhaustive paper by the inventor of the Inclination Scale. They, as well as similar abstracts, presented by the writer to the United States Association of Charcoal Iron Workers, (Journal, Vol. VIII., No. 5), a few years ago, of Prof. Thalen's Magnetometer, are merely intended to direct the attention to a class of instruments in use in Europe, but seemingly unknown among mining men in America, for locating a magnetic ore deposit.

TRANSACTIONS

OF

The Mining Society of Nova Scotia.

The Society as a body is not responsible for the opinions and views expressed in the several papers presented with the Transactions.

VOL. II. SESSION 1893-94. PART IV

The December Quarterly Meeting of the Society was held in the Rooms of the Society, 129 Hollis Street, Halifax, on Thursday the 7th December. Among those present were: H. S. Poole, Stellarton, N. S.; John E. Hardman, Oldham, N. S.; David MacKeen, M.P., Sydney, C. B.; R. H. Brown, Sydney Mines, C. B.; F. H. Mason, Truro; B. C. Wilson, Waverley; T. R. Gue, Halifax; B. T. A. Bell, Ottawa; G. W. Stuart, Truro; D. Turnbull, Sheet Harbor; Charles Archibald, Cow Bay, C. B.; C. E. Willis, Halifax; H. G. Stemshorn, Mooseland; J. H. Austen, Halifax; Duncan MacDonald, Truro; A. A. Hayward, Waverley; Frederick Taylor, Oldham; W. Blakemore, Cardiff, Wales; J. J. Penhale, Black Lake, Que.; G. E. Francklyn, Halifax; W. Lithgow, Halifax; Hugh Fletcher, Ottawa; R. G. E. Leckie, Torbrook, and H. M. Wylde, Halifax, Secretary.

Mr. H. S. Poole, President, who occupied the chair, called the meeting to order at 11 a.m.

The Secretary read the minutes of the previous meeting which were confirmed.

NEW MEMBERS.

The following names for membership were handed in: L. J. Fuller, J. D. Copeland, Alexander MacQuarrie, M. R. Morrow and Hector McInnes.

On motion these gentlemen were declared duly elected

A PROVINCIAL MUSEUM BUILDING WANTED.

A letter from Mr. A. H. McKay was read asking the co-operation of the Society in relation to the erection of a building designed to provide accommodation for the Victoria School of Art and Design, the Provincial Museum, the Akins library and for meetings of the Institute of Natural Science, the Mining Society and for other purposes.

The President expressed the opinion that this Society should lend its countenance to such a movement.

Mr. Gue suggested that it be left to the Secretary to secure the co-operation of such members of the Society as were available when the matter came up.

It was therefore resolved that the Secretary of the Society be a committee with such members as he might associate with him to assist in carrying out the views expressed in the letter of Mr. A. H. McKay.

EFFECT OF A LIGHTNING DISCHARGE AT THE SCOTT PIT.

Continuing the Discussion of Mr. Chas. Fergie's Paper, read at the last meeting, Mr. J. G. Rutherford, Stellarton, wrote:—

"In 1835, before a Select Committee of the House of Commons on Accidents in Mines, George Stevenson, of locomotive and safety lamp fame, while admitting that the electric spark artificially produced would explode a mixture of fire-damp and air of a proper degree of inflamability* doubted the possibility of lightning causing an explosion of gas underground, and added 'I have never known or heard of an instance of a mine being fired by lightning.'"

*NOTE.—This idea is now known to be erroneous.

Mr. John Buddle, probably the most practical mining engineer of his day, who was examined by the same committee a week later, in reply to the question, "In addition to the other contingencies, you have expressed a general opinion that those accidents may result from the sudden discharge of electricity produced from natural causes?" said "They may, but that is generally visible. I have never known an explosion from lightning except when it ignited the gas at the top of the pit." In support of his opinion he instanced the Lawson Main Pit, 70 fathoms deep, and not particularly fiery. The ventilation having been deranged from some cause, the workings were filled with gas and as he expressed it, "the shaft itself became a gas pipe and was then discharging what was generated below. This discharge was ascending in a current from the mouth of the pit, when the thunderstorm came on; a flash of lightning ignited the gas and a very heavy explosion immediately ensued." He stated that he had no connection with the colliery, but happened to be near the pit when the explosion occurred, and what is of further interest, he said "I went to see the havoc that had been made at the Lawson Main Pit, and had been there a short time, with a great number of other people, when another explosion, a most furious one, took place, when I was within 18 feet of the top of the shaft." This explosion occurred about an hour and a half after the first. He also informed the committee that his father had seen lightning descend the pumps in an engine-shaft, and while doing no more harm than alarming an engine-wright in the shaft by its "rattle," spent itself in the water in the sump below. Buddle's opinion was that had the pit bottom been foul an explosion would have immediately taken place.

At Tanfield, Moor Colliery,* in the County of Durham, on July 12th, 1880, a flash of lightning passed down the working shaft, 216 feet deep, struck the flat sheets and then divided and passed through the workings, where over a distance of 70 chains it was seen by several men at various points. A commitee of

*Transactions North of England Inst. of M. and M.E., Vol. xxx, Part I, p. 31.

the Institute carefully investigated the matter and was satisfied from the evidence taken that the report was correct. No damage resulted on this occasion. There were two columns of steam pipes in the shaft, the exhaust extending 25 feet above the mouth. A heavy peal of thunder was heard underground simultaneously with the lightning. The characteristics of the discharge as observed were a flickering, unsteady light on the rails, accompanied by a noise resembling the explosion of gun-caps.

In the course of a long discussion which followed, Mr. D. P. Morrison mentioned a similar case occuring at Acomb, Hexham, at a pit that had been closed for two years. The wire-rope guides and ropes had been left in the shaft when abandoned, as well as the cages and the mouth of the shaft railed off, and it was impossible for anyone to be below, on the Sunday afternoon when in the midst of a thunderstorm and simultaneously with a flash of lightning, the pit blew up and the cages, ropes, etc., were thrown to the surface.

Mr. Henry White described a case of lightning descending the shaft of the West Thornley colliery on December 11th, 1883,* where on two previous occasions a similar electrical discharge had been observed. This colliery was 1000 feet above sea level and was sheltered on one side by a hill 50 feet high. The shaft was 25 fathoms deep, had steel ropes and cages, iron rail guides, iron buntons, four rapper-wires and three columns of steam pipes. According to the evidence of those employed at the shaft bottom, the lightning appeared to have descended by a rapper wire and then glanced to an uncovered portion of a steam pipe. There was a brilliant light and "a noise like that of the firing of a gun." The winding engine man saw the lightning strike the pulleys and the colliery chimney was struck and much damaged at the same time, but there was no damage done underground.

On the two previous occasions when the pit had been similarly visited, slight shocks were sustained, in one case by a banks-

*Trans. North of England Inst. of M. and M.E., Vol xxxiii, Part III, p. 81.

man who had his hand on the cage's neck, and in the other by the underground engineman who had hold of the throttle valve handle and who also saw the lightning. It was supposed in both cases to have struck the rope and passing through the steel cage, continued its way by the iron guides to the bottom and thence along the rails where on the first occasion it was seen on the rails 80 yards from the shaft.

On October 21st, 1886,* the same colliery was again struck despite the fact of a lightning conductor having been placed on the chimney which was only 68 feet away from the pulleys and 25 feet higher. On the day of the discharge a severe thunderstorm with much rain prevailed and the lightning went down the pit twice in five minutes. An onlooker close to the cage said the lightning appeared to come down the rope; another farther away but within 18 inches of the steam pipe, saw the light and received a slight shock in his elbow, and the hauling engineman, 40 yards from the shaft, stated that his engine house was lighted up and he heard a sharp report which led him to suppose that some part of his machinery had broken. While examining his engine he saw a second flash. Two lads attending a landing 660 yards from the shaft saw the place lighted up and heard a fizzing sound which was repeated five minutes afterwards.

DISCUSSION.

Messrs. R. H. Brown, Charles Archibald, and W. Blakemore took part in the discussion on the above paper.

GOVERNMENT AID TO MINING.

The PRESIDENT suggested that the paper by Mr. J. F. Hardman on the subject of "Government Aid to Mining," be read before the Mines Committee of the House of Assembly. He thought it would be well if a resolution was moved to that

*Trans. North of England Inst. of M. and M.E., Vol. xxxvi, Part I, p. 47.

effect. The Society should ask permission to appear before the Committee of the House and lay their views before it.

MR. G. W. STEWART moved that the Council of the Society send a committee before the Committee of the House of Assembly on Mines and Minerals.

MR. J. H. AUSTEN seconded the motion, which was agreed to.

The PRESIDENT said it would be well for members of the Society who have any suggestions to make respecting mining legislation to do so now, so that they might be embodied in the letter to the Provincial Secretary which at the last meeting of the Society he had suggested might be submitted.

THE DUTY ON MINING MACHINERY.

MR. B. T. A. BELL—In view of the visit of the Rt. Hon. Sir John Thompson and Sir Charles H. Tupper to Halifax this week, would it not be advisable that a deputation from the Society obtain an interview and explain the necessity for some clearer interpretation of the law relating to the imports of free mining machinery?

MR. CHARLES ARCHIBALD—This would be a good opportunity to bring the matter before the Government.

MR. B. T. A. BELL—I may add that the General Mining Asociation of Quebec has been notified by the Hon. the Comptroller of Customs that the resolution of that body asking for an extension of the language of the Act will receive consideration by the Government when it revises the Tariff.

MR. G. W. STEWART did not think that any of the gold mining men had difficulty in getting in free of duty gold mining machinery which could not be manufactured in the country. At least he knew of no instance where duty had been paid on machinery which could not be manufactured in the country.

But so far as gold miners were concerned, there was a subject of even greater importance than that of the duty on machinery He referred to the duty on explosives. The bill for explosives, year in and year out, was far in excess of that of machinery There was another difficulty. There was not a railway in the United States that objected to carry dynamite, while the I C R would not carry it under any consideration, and the manufacturers suffered as well as the consumers in consequence. He thought that any committee appointed to interview members of the Government, should discuss these matters as well.

MR. BELL thought that with the general tenor of the Customs Law, there was no great objection. Unfortunately, however, members of this Society who had to import such specialties as coal-washing and briquette-making machinery, had been given a ruling that according to the language of the law, plants of these and similar kinds were manufacturing and not mining plants An altogether erroneous construction. The Government had promised to consider the matter and a quiet talk with the Ministers explaining the situation would doubtless be of benefit to the stand the Society has already taken in the matter.

MR. STEWART asked whether Mr. Bell objected to having the question of explosives dealt with at the same time.

MR. BELL said that he had not considered the question

MR. JOSEPH AUSTEN said that his firm had been in communication with the Comptroller of Customs in relation to the duty on wrought iron pipe of over two inches in diameter This was mining machinery in every sense of the word as no pump was complete without it, but the Comptroller of Customs said that such pipe, above two inches in diameter, could not come in under the head of "mining machinery." His firm had imported a quantity of six inch pipe for the New Glasgow Coal, Iron and Railway Co., and different mines imported large quantities of pipe ranging in diameter from three and four to six inches. This was a very important point.

MR. DAVID MACKEEN, M.P., thought Mr. Bell's idea a good one. It was very much in a line with the contentions

recently made by the Dominion Coal Co., Limited. He would be more than pleased if a committee of the Society could have an interview with the ministers and have the matter fairly represented to them. Instances continually arose where officials maintained that machinery of a certain description was not mining machinery. The trouble was that they did not understand it, and he thought it would be well to have a schedule of such machinery as might be required made out and presented to the Ministers. In respect to wrought iron pipe, he was rather of the opinion six inch wrought iron pipe was admitted free of duty. The Dominion Coal Company imported some the other day, and he did not think that they were required to pay duty after representing the matter. In view of the unsettled state of the tariff question, he thought it might be premature to make a demand for concessions. There might be some very material changes made with respect to machinery.

MR. BELL said the question was merely with respect to the interpretation of the present Act.

MR. HAYWARD said that to gold miners the question of explosives was a very serious one, and if the Ministers were to be waited upon, he would like this question to be brought up.

MR. HARDMAN thought it would be better, simply to appoint a committee and instruct them on various points, rather than pass a resolution defining what the duties of the committee were to be.

MR. MACKEEN said there could be no use in giving any detailed instructions to the committee. It could only be a *pro forma* matter in any case. A committee would be appointed and certain contentions would be brought to the notice of the Ministers, and for the present, that would be the end of it. If one member of the committee who favored a change in respect to explosives was appointed, and another who favored a change in respect to the duty on mining machinery, the views of all parties could be brought out.

MR. STUART—Why do you object Mr. Bell, to adding the question of explosives to your resolution?

MR. BELL—Mainly because the Society has unanimously put itself on record respecting the mining machinery question, while the subject of explosives has not been before the Society until to-day. In the order of business, he thought Mr. Stuart should put his resolution separately, and have it discussed by itself. Personally, he knew nothing about the explosive question further than he was strongly of opinion that the home manufacturer should be encouraged. He would move the following:

(a) "Resolved, that a deputation from the Society obtain an interview with the Right Hon. Sir John Thompson during his present visit to the Province respecting a more liberal interpretation of the law relating to the importation of mining machinery not manufactured in Canada."

(b) "Resolved, that the same deputation urge the necessity of the carriage of explosives on Government lines of railway."

The resolutions were respectively seconded by Mr. John Hardman and Mr. Frederick Taylor.

MR. STUART moved, seconded by Mr. Hayward that the discussion be adjourned and be resumed at 2.30 p.m.

The PRESIDENT put this resolution which was declared lost.

MR. HAYWARD then moved in amendment to Mr. Bell's resolution, seconded by M. Archibald, "that the committee be also instructed to urge the reduction of the duty on explosives imported into Canada."

MR. STUART said that the cost of explosives here was a hundred per cent. more than it was in the United States, and he failed to see why people operating mines should be placed under such a burden.

MR. HARDMAN said that the effect of a reduction of the duty on explosives would be that dynamite would be imported and would not be made in this country as it could be. The question in respect to machinery had been before the Society for three years and had been before the Quebec Association for the same length of time, while the question as to explosives had never been brought up before. There was no connection between the two questions and no reason why they should be embodied in the same resolution.

MR. BELL said that dynamite and other explosives were

made in the country, and he was in favor of making them as cheaply as possible.

MR. HAYWARD said he did not see that any further discussion as to the duty on explosives was necessary. He had not heard any valid reason given for refusing to incorporate that matter in the resolution.

MR. BELL said he would agree to the two clauses of his resolution being consolidated, but he could not consent to adding free explosives.

It being lunch time, the Chairman put the resolution which was carried, together with Mr. Hayward's amendment.

AFTERNOON SESSION.

AMENDMENTS TO THE MINES ACT.

The members assembled in the rooms at 3.30 p.m.

The Society proceeded to the discussion of amendments to be submitted to the Committee of Mines and Minerals of the House of Assembly in relation to coal and gold mines.

MR. G. W. STUART thought that deputy commissioners should be appointed for the different gold mining districts. Many outlying districts suffered from being so far from the head office.

MR. J. C. McDONALD contended that deputies should be appointed for the various districts, to place people living in the districts, in as good a position as people living in Halifax. People in the city took up areas and held them for sale only.

MR J. E. HARDMAN thought that the best policy would be to abolish the present deputies. He thought the Government would probably do that more readily than they would appoint others.

MR. STUART proposed the amendment of chapter 122 of the Revised Statues (4th series) "of the partition of lands," so as to make it applicable to gold areas held by two or more persons who could not agree as to the working of the areas. He read a draft Act which had been prepared with this object; also an Act to amend the Act to consolidate the Acts relating to mines, making areas held by two or more persons subject to the Act in respect to the partition of lands.

MR. HARDMAN thought the remedy proposed would meet the case.

MR. FREDERICK TAYLOR said that the chapter of the Revised Statutes referred to, at present only applied to real estate. The amendment making the chapter applicable to mining areas, he thought was exactly what was wanted.

MR. GEORGE STUART said that there were many good

properties lying idle because the parties owning them could not agree either to work or to sell.

Mr. C. E. WILLIS asked whether if a property was sold under the Act one of the parties could not buy it.

MR. STUART—Certainly.

MR. A. A. HAYWARD thought that if one of the parties was a man of means, and the other a poor man, the enforced sale would give the former a strong lever against the latter.

MR. HARDMAN said the parties would no doubt try to come to an amicable arrangement rather than allow the property to be sold.

MR. B. C. WILSON said that there was a great unfairness in the law as it stood at present. He thought the remedy proposed would be satisfactory. He had had some experience of the working of the law in connection with real estate.

MR. J. C. McDONALD asked whether there was any provision for sale in any other way than by public auction. Such a sale was often a poor criterion of value.

MR. B. C. WILSON said it would be the duty of the arbitrators to make a fair division if they could, as in the case of real estate. If the parties could not agree among themselves, and a fair division could not be made, there was no alternative but to sell.

MR. J. E. HARDMAN said that the effect of the amendment proposed, practically, was to make mining areas real estate.

MR. B. C. WILSON said that if the chapter was made applicable, the properties would be divided with the minimum of injustice.

MR. A. A. HAYWARD thought that present ownerships should not be disturbed.

MR. G. W. STUART said that many properties which should be productive were now lying idle.

MR. C. E. WILLIS did not think there was any advantage on one side more than the other.

MR. JOS. H. AUSTEN said it would be a good argument for the poor man to address to the arbitrators that his co-owner was trying to freeze him out.

MR. JOHN HARDMAN said that the fact that such an Act was found to be necessary in the case of real estate showed its necessity in the case of mining property.

MR. JOS. H. AUSTEN thought that while there might be an occasional injustice the remedy proposed would be of great assistance.

On motion of Mr. Stuart, seconded by Mr. Taylor, it was resolved that the amendment proposed, be brought to the notice of the Committee of the House of Assembly on Mines and Minerals.

MR. JOHN HARDMAN moved that the Council be instructed to embody in a communication to the Government the views presented at this and past meetings, relative to amendments to chapters seven and eight of the Revised Statutes. The Mines and Minerals Act, and the Mines Regulation Act.

MR. B. C. WILSON seconded the motion, which was passed.

The meeting then adjourned until 8 p.m.

EVENING SESSION.

At the evening session which was held in the St. Julian Dining Room, Halifax Hotel, there was a large attendance, probably the best since the Society was organized, the President in the chair.

The meeting proceeded to consider the following paper:

IRON MAKING IN NOVA SCOTIA EARLY IN THE CENTURY.

By Mr. H. S. Poole, Stellarton.

The successful establishmant of Iron Works at Ferrona, in Pictou County, according to the most modern practice, makes all the more interesting to record an early trial, made over sixty years ago, to produce pig iron from ores of that County.

When the General Mining Association obtained the mineral concessions granted the Duke of York, the coal pits at the Albion Mines, now called Stellarton, were opened on a greatly extended scale. A large brick building was put up in 1828 for foundry, machine shop and milling purposes. Power was obtained from a condensing engine, which is still on the ground.

At the same time the sum of £1000 was put aside for the purpose of experimenting in Iron making. A furnace was erected on the north side of the foundry in front of an archway, now bricked up, that led into the casting house. No plan of the furnace has been found. It was probably about forty feet high and eight feet in diameter at the boshes. It was lined with special brick a foot thick, made key shape to suit the circle, and backed with a course of stretchers, between which and the casing there was a space of four inches filled with sand. The casing was eighteen or twenty inches thick, built with a batter and hooped. The hearth was built of special brick set on end. This furnace was not pulled down until 1855. An inclined way, laid with iron rails, led to the top of the furnace for charging purposes.

The season of 1829 was spent in experimenting with the several ores of the district. A small quantity of limonite was obtained from the Fraser-Saddler property at Bridgeville, but the bulk of the ore tried was red hæmatite brought down McLellan's brook from the locality now known as Iron Mines Post Office, where it is naturally exposed, and was easily got by open quarrying. The clay ironstone nodules, which occur in the coal were also carted down from the pits to the foundry, and roasted in open heaps. In the search for iron ore Coal brook was well explored and a surface trench followed up the brook for 800 feet. This trench was timbered, and when opened a few years ago, much of the timber was found to be sound.

The blast for the furnace was got from the foundry engine erected in 1828, and which continued in use until 1871, when new machine shops were put up. The engine was condensing and the pressure of steam carried was about five pounds, regulated by a tank of water placed at the necessary height. When in the course of time leaks in the boiler occurred, temporary repairs were affected by a layer of horse manure covered by a plate of iron.

Besides the plant referred to preparations were made for operating on an extended scale, and a blowing engine was imported. The air cylinder of this engine remained lying on the river's bank, where it had been landed half a century before, until 1884, when it was broken up. But the steam cylinder and beam were utilized in Gordon's pumping engine at the bye pit of the second lift of workings, afterwards known as the "Crushed Mines," and the blast pipes found service as a conduit for the first fill on the South Pictou or Albion Railway below New Glasgow, where doubtless they may still be found.

It is said that in all some 50 tons of metal were made, but of a quality that was useless for foundry purposes; it was hard white iron, pieces of which still lie about the yard. Of what was made part was used as ballast for the slip at Shipyard Point, on the East river. Weights about the colliery were made of it.

The "baby" on the rope used in the Foord pumping pit is still on hand, and current report confirms Professor How's statement that stampers of a quartz mill at Waverley, made of it had been pronounced to be ten times more durable than Belgian iron.

Mr. Joseph D. Fraser, chemist at the Ferrona iron works, who has interested himself in these early operations, interviewed James McDonald, now 85 years old, one of the prospectors for ore, and his story is:—That the Rev. Dr. McGregor, on whose farm the coal of the Albion Mines was found in 1818, accompanied Mr. Richard Smith, the manager at the Albion Mines, in 1828 up McLellan's brook and obtained samples of hæmatite ore which were sent "home" to be analysed. The report received was favorable and accompanied by a snuff-box pen--knife and razor, made from the sample. Mr. McDonald was then employed getting out ore at Blanchard, where it was found solid at a depth of 13 feet, and was blasted out for transportation to the Albion Mines.

Haliburton in his history, page 428, speaks of an experiment having been "made at the Albion works to reduce some of the clay ironstone, mentioned in his mineral section, viz.:—No. 4, 144, 156 and 158, into iron in a crude state, by means of a small cupola erected especially for melting pig iron for foundry purposes only, and which is not at all calculated for smelting ore. The cakes having been prepared in the ordinary way, and the ironstone calcined, the proper proportions of each were gradually introduced into the cupola, to which was also added a little limestone for a flux. In a few hours this small melting pot (for so it may be termed) produced a result of 35 per cent. of metal, which was so lively and fluid in its nature, that the workmen employed, cast from it some delicate ornaments, and the remainder was formed into pig iron of No. 1 quality, presenting a fine smooth face, and yielding freely to the file and drills."

This experiment can hardly refer to the special furnace elsewhere mentioned, but it may have led to the trials in the larger furnace which local tradition says were protracted and met with many difficulties. On one occasion it is reported the metal in

the bottom cooled and had to be cut out by hammer and chisel. Certain it is the furnace first used was rebuilt.

Mr. Fraser also furnishes an analysis he made of the metal cast in 1829 at the Albion Mines:

Silicon		0.409
Manganese		0.504
Sulphur		1.238
Phosphorus		0.788
Combined Carbon	1.295	
Graphite Carbon	0.668	
Total Carbon		1.963
Metallic Iron		95.098
		100.000

Of the ore got from McDonald's,* at Blanchard, an analysis was published in the Mines report, page 81, for 1874, as follows:

Oxides of Iron	60.71
" " Manganese	0.18
Silica	29.97
Sulphur	0.09
Phosphoric Acid	0.63
Yielding Metallic Iron	42.50

An earlier attempt at iron making than this in Pictou County, Haliburton page 163, tells us was made at Nictau many years before he wrote in 1828–9. He further tells us that in 1825 the Annapolis Iron Mining Company obtained a charter and bought iron lands in Annapolis County, at Nictau and other spots; finally selecting the right bank of Moose River, eight miles from Annapolis for the site of their furnace and erections. Dr. Gesner, in his Industrial Resources of Nova Scotia, 1849, describes the works, page 255, but speaks of what they were, how that "the smelting, casting and manufacture of iron commenced under the most favourable auspices, and both the ore and the iron produced from it proved to be unexceptionable."

*Fletcher's Geological Report, 1892, p. 182, P. Patterson's History of Pictou, p. 425.

but for reasons he enumerates "the trip hammers ceased to move, and the pretty village of Moose River was deserted by all its inhabitants."

Dr. How, in his Mineralogy of Nova Scotia, 1869, page 100, quotes from Knight's Prize Essay on the Resources of the Province, that smelting operations were resumed at Clements after a stoppage of thirty-three years, and on the authority of the Bridgetown Register that in 1862, five tons of iron a day were being turned out. In a year or so the works were again closed and so remained until 1874, when a partial attempt to re-open was made.

Messrs. Jackson and Alger, in their Mineralogy and Geology of Nova Scotia, 1832, describe what they saw of the Province in 1827. They mention that "the bed of ore at Nictau has been opened to the depth of eight or ten feet, and some hundred tons of the ore have been removed to the smelting furnace, situate on the southern shore of Annapolis Basin." Again they say, page 89, when referring to the ores of the South Mountain, between Nictau and Clements: "Should the spirit of competition among iron manufacturers in Nova Scotia ever equal that which characterizes some quarters of the United States, it is believed that no part of this range will long remain unexplored or fail to produce abundantly that article, on which depends so many other arts and manufactures." A spirit of competition, as is well known, has arisen in the Province, but it still leaves this district of country practically untouched. In this section of country the ores are all highly metamorphosed by proximity to masses of granite, but eastward of Nictau river, on the extension of the same range, as distance from them is attained, the effect decreases. At Wheelocks, only some of the bands of shell ore are magnetic, while at Torbrook, still farther away, the ore is altogether red hæmatite. Of the deposits at the latter place and the district in general, we have an interesting paper by Mr. R. G. E. Leckie, published in part 2 of volume I. of our transactions. Messrs. Jackson and Alger also refer, page 96, to the closing of the establishment at Clements.

But the connection of both these authorities with the early iron making in Nova Scotia is more clearly explained in a letter of October, 1855, by the former to Mr. Charles D. Archibald, respecting the Victoria Mines at Nictau. In the letter in question, written from the State Assayer's office in Boston, Dr. Jackson says:—"The ores from Nictau Mines were smelted under my observation at Clements, N. S. in 1827, and I had then an opportunity of seeing the excellent iron which they produced, both pig iron for foundry purposes and bar iron. Mr. Cyrus Alger, the distinguished iron founder, began the enterprise of working the iron ores of Nova Scotia at the Annapolis Iron Works, and met with all the success that could have been expected in the business, though the works suspended operations ultimately, owing to political causes." He then speaks of the advantages possessed by Nictau for making charcoal iron, of the inexhaustible supply of iron ores at that locality and the quality of the ore. Concerning the latter he says:—"It will be seen by my analysis, that there is between 5 and 6 per cent. of lime in the ore, nearly enough to form a fusible slag with the silica and allumina, with a little oxide of iron. This ore is certainly the most remarkable of any known in America, both for its abundance and its singular constitution. It is one of the very best known in the country for the production of the finest iron, both foundry and forge pig."

Dr. Jackson was accompanied on his visit in September 1855, by Mr. John L. Hayes of Washington, who also made a report on the property. Among other things he said: "Fortunately the excellent qualities of this ore and the facility with which it is worked in the blast furnace have been practically demonstrated. Bar iron was made from this ore in a small catalan forge some fifty years since, and several hundred tons of it were smelted in the blast furnace which was formerly in operation upon Moose River." * * "Having been personally engaged in the manufacture of charcoal iron, and having visited nearly all the charcoal iron establishments east of the Alleghany Mountains, I know no locality in the United States which

present advantages equal to those of Nictau." * * I have conversed with Mr. Alger, who erected the furnace at Moose river, and he confirmed the statements I have made that the Nictau ore was worked in the furnace with more facility than any other ore which could be found."

Mr. R. F. Mushet is also made to speak in the same unqualified terms of the excellence of the iron made and the "unrivalled" character of the ore for iron making. With such recommendations the Acadian Iron Mining Association succeeded in raising in London the necessary capital to float the Acadia Iron Company, which built works at Nictau, and according to Professor How, exported in 1858 some 744 tons of iron, and in 1859 some 1125 tons.

Dr. How also describes the shell ore with distinct polarity, a most unusual feature, and he adds, with reference to the phosphorus in the ore which the Rev. Dr. Robertson informed him "is supposed to depress the marketable value of the iron." "I have learned from another source that the ore contains phosphorus and the quality is said to be injuriously large." And yet the analyses of Dr. Jackson do not show either phosphorus, sulphur or titanium.*

Dr. Harrington gives notes on the iron ores of Canada in the Geological Report of Progress for 1873-4:

One of the furnaces built at Nictau was 35 feet high, 9 feet in diameter at the boshes, and 4½ at the throat. The second furnace was of the same diameter but 3 feet higher.

At Clementsport the furnace that was repaired in 1874 was "35 feet high, 4 feet in diameter at the hearth, 9½ feet at the boshes, and 7 feet at the throat. It had three twyers, and the blast which is hot and has an average pressure of 1¾ to 2 lbs to the square inch, is produced by water power; and the wheel, a breast wheel, is 30 feet in diameter. The blowing cylinders, three, are of cast iron, 4 feet in diameter and 5 feet stroke.

*As these notes only relate to iron making early in the century, reference to the operations at Londonderry, in Colchester County begun in 1849, is purposely omitted.

The blast is heated by burning the waste gases from the furnace in a hot blast oven containing 17 siphon pipes, through which the air is made to pass. The oven is on a level with top of the furnace, and is of brick, bound with iron. The ore, called 'grey magnetic' is from the Potter mine and yields 45 per cent. of pig iron, but of poor quality, unless an equal weight of Bloomfield bog iron ore, which carries 26 per cent. of metal, is used when the quality is improved. The fuel is charcoal, 130 (Winchester) bushels making one ton of pig. The limestone used as flux is from St. John, N. B."

The report of the Department of Mines for 1873 by the writer, states that in that year 630 tons of ore were smelted, and the metal produced only 180 tons. Part of the ore having been taken from the Miller mine. Analysis of the Nictau ores were given in the report for 1874, page 81; and for 1875, page 61, shewing sulphur from .05 to .09, and phosphorus from .16 to .79 per cent.

DISCUSSION.

MR. R. G. E. LECKIE said that he hoped to be able in a short time to prepare some notes to add to Mr Poole's paper.

MR. H. S. POOLE stated that Mr. Fletcher of the Geological Survey was present. Mr. Fletcher, if not already familiar with the country referred to, would work over it shortly and the Society would be glad to hear from him.

MR. HUGH FLETCHER said that he had visited the country some few years ago, and he had taken some notes, but Mr. Leckie, no doubt, was much more familiar with it than he could be, after such a short inspection.

MR. B. T. A. BELL moved a vote of thanks to the President for his valuable contribution to the literature of the Society. The paper, together with that read at the June meeting by the Rev. Dr. Patterson, on the Early History of Coal Mining in Pictou County would be exceedingly valuable for reference.

MR. JOHN HARDMAN took pleasure in expressing his concurrence in Mr. Bell's remarks and in conveying to the President the assurance that the paper read by him was one of the most valuable contributed to the Society.

GOLD CHLORINATION.

A DESCRIPTION OF THE NEWBURY VAUTIN PROCESS,

BY F. H. MASON, F. C. S., TRURO.

I will first draw your attention to the Chlorinator used by the Newbury Vautin Co., of which I have made a rough sketch and colored it equally roughly, but it will enable you more plainly to see of what the different parts are constructed.

The figure represents a front elevation of the chlorinator with the cover in section. The main body of the chlorinator is made of wood bound together by bands of wrought iron, and is swung on trunnions which are supported on V shaped castings: both the covers are detachable and are fastened on by bolts and nuts, the joint is made of asbestos cloth, soaked in melted paraffin or sometimes of rubber; the whole of the inside is coated with paint, the body of which is made of ferric oxide, which has been found to be capable of resisting the action of Chlorine, but the continual abrasion of the ore against the sides of the cylinder, renders it necessary to renew this coat of paint fairly often, and this I consider one of the weakest points in the construction of the machine.

In the centre of one of the covers is a tap made generally of glass lined iron tubing, with a stoneware or vulcanite cock, in some cases the whole tap is made of stoneware.

The filter bed a section of which you see is made of wood, with grooves turned in it and holes are made in these grooves right through to the other side, the whole of the wood is coated with the paint already mentioned; a piece of stout closely woven

canvas is stretched across this and forms the filter. The crests of the corrugations (if I may use the expression) support the canvas and enable it to carry the weight of the ore, while the auriferous solution percolates through the canvas into the troughs from whence it runs away down the holes.

Having described the machine I will now by the aid of this skeleton section through a chlorination works, metaphorically speaking take you over it and point out the methods of conducting the processes as we go along. The concentrates are brought into the sampling room, where they are thoroughly mixed and laid out into a square of uniform thickness, string is stretched across this square from pegs, placed around the sides at equal distances from each other, thus dividing it into a series of little squares, from each of which a box capable of holding two pounds is filled and placed on one side to form the sample; this if properly carried out should form a fair sample, which is sent to the laboratory where a pot assay is made of it, it is then roasted in a small roaster placed outside the laboratory, the loss of weight through roasting noted, and an assay of the roasted concentrates made, the increase in the percentage of gold in this second assay should of course be directly proportional to the loss in weight through roasting. From the roasted ore quantities of about three pounds are taken and placed in stoneware bottles made for the purpose, it is then made into a thick mud with water, and chloride of lime, and sulphuric acid added, the proportions of these last two substances varying in each bottle, (thus supposing four experiments were made one might contain ½% of chloride of lime another 1% and the others 1½% and 2% respectively) these are placed in a cylindrical box connected by a belt to the main shafting and rotated at from 10 to 12 revolutions per minute for a given length of time. The contents are then turned out and thoroughly leached with water and the tailings assayed; the best of these experiments, viz.: the one taking out the gold with the least chloride of lime is repeated in a miniature chlorinator constructed exactly similar to the larger ones and

capable of holding about 100 lbs. of ore; if this result is the same as in the smaller experiment, then the quantities of chloride of lime used in this experiment will also be used in the actual chlorination. The ore is now taken from the sampling room, placed in trolleys and run up the lift to an elevated trolley line running along the centre of the roasting room (I could not very well show it in the sketch) and is shot through a chute into the roasting furnaces of which there are four, two on each side; when roasted perfectly sweet it is removed, placed in trolleys sent up the lift to the top floor, and from there shot through hoppers into the chlorinators of which there are ten, five cn either side, each of which is capable of holding from one and a half to two tons of ore; from the bottom of the hoppers there is a canvas pipe to let the ore right into the chlorinator and prevent dust getting about the building.

After the first trolley of ore has been shot into the chlorinator, the chloride of lime is put in, then the remainder of the ore and sufficient water to make the whole into a thick mud, the cover is now put on and a turn or two given to the chlorinator to thoroughly mix the contents, then the sulphuric acid is added and the cover fastened firmly on, air is pumped in through the cock until a pressure of 60 lbs is obtained; the chlorinator is then set revolving at from 10 to 12 turns per minute.

When the chlorination is completed the required time being known from the results of the small experiments, the chlorinator is stopped with the cock uppermost, and any excess of chlorine is allowed to escape outside the building through a rubber pipe attached to the cock; the chlorinator is then turned over, the cover taken off and replaced by the filter bed, the machine is once more turned over, the lower cock opened and water forced through the upper cock, if difficulty is found in filtering, a suction pump having an intermittant action is employed under the filter bed, by which arrangement it has been found that the ore is less liable to clog. The leaching is continued so long as the solution contains any gold. Any silver there may have

been in the concentrates will have been converted into chloride, and if there is sufficient to pay for extraction, either a saturated solution of braie or a solution hyposulphate of soda is put into the chlorinator, and it is set revolving again. The silver solution is afterwards leached out and the silver precipitated on metallic copper, which in its turn is again precipitated on scrap iron. When the leaching is finished the top cover is removed and the chlorinator turned over the ore falling into a hopper below and is washed away down a chute to the outside of the building where it is either taken away by trolleys waiting to receive it or run directly into a stream. Now comes the recovery of the gold from the auriferous solution, and here I want to bring to your notice a precipitant which is not I believe generally known. The gold chloride is passed up through a stoneware or glass pipe containing powdered grey sulphide of copper and directly it comes in contact with this substance it is instantly precipitated, mainly as metallic gold together with sulphur, copper chloride going into solution, this copper chloride flows out of a small exit at the top of the pipe, and is run over scrap iron on which it is precipitated as cement copper, this is afterwards dried and fused with sulpher, which once more converts it into sulphide of copper. When the copper sulphide has become sufficiently charged with gold to necessitate a "clean up" it is simply melted in a crucible and poured into a mould. The gold by virtue of its higher specific gravity sinks to the bottom, while the copper sulphide forms a regulus above it, from which it is easily detached. For some reason which I hoped to have been able to explain to you but have not had the time to devote to it, the gold always carries a certain amount of copper down with it, but in a chlorination works it is a simple matter to refine this by the Miller process with which you are probably all acquainted. I think the probable reason for this is that the leachings always contain a certain amount of free chlorine. This being a powerful oxidizing agent converts some of the copper sulphide into sulphate, and these two react on each

other in the crucible with the formation of metallic copper and sulphurous anhydride.

$$Cu\,SO_4 + Cu\,S = Cu_2 + 2\,SO_2.$$

The sulphide of copper from which the button is detached always retains a small quantity of gold, but as this retention is not accumulative it is a matter of small moment because it is ground up and used once again as a precipitant, so no gold is lost. To chlorinate roasted sulphurets it requires on an average from 1 to 3 per cent. of a good chloride of lime (having over 30% of available chlorine) and about double that amount of sulphuric acid, that known in the trade as B. O. V. or brown oil of vitrol being used.

The duration of the process lasts from two to six hours and depends of course mainly on the coarseness of the gold particles and on the quantity of gold present; the addition of pressure in the chlorinator considerably reduces the time necessary to complete the process.

I hoped to have been able to give you the results of experiments on several sets of Nova Scotian concentrates but owing to circumstances over which I had no control, I am unable to give you the results of experiments on more than one set of concentrates; two or three gentlemen promised to let me have concentrates from their mines, but owing no doubt to pressure of work failed to fulfil their promises, however our worthy vice president was kind enough to let me have a sample of the concentrates he is saving at Oldham and the result of my work on them will I think clearly show the advantage of saving such concentrates. There are I believe several mines in Nova Scotia to day, which are letting valuable sulphurets go merrily away with their tailings and to them, or rather to their owners, the old adage of "what the eye does not see the heart does not grieve after" particularly applies.

The results of my experiments on the tailings from the

mines of Messrs. Hardman and Taylor, at Oldham, I will give you in a tabulated form.

Pot Assay	Loss per cent. on Roasting.	Assay after Roasting	Tailings Assay after 1 Chloride of Lime 3 hours.	Tailings Assay after 2 Chloride of Lime 5 hours	Tailings Assay after [illegible] Chloride of Lime [illegible] hours
3oz. 8dwt 14 grs.	32	4oz. 19dwt. 23grs	1oz. 11dwt. 11grs	6dwt. 12grs.	[illegible]

The cost of roasting and chlorinating this ore would I estimate roughly range somewhere between \$5 and \$7 per ton which would leave a very handsome profit. The plant of which I have given you a skeleton sketch would be capable of chlorinating 30 tons of ore per day of 10 hours, but the number of roasters would have to be increased if only sulphurets were treated. The original cost as well as the running of the plant as you will readily see is not a very heavy one.

I am convinced that if the gold miners of Nova Scotia would combine and start a central plant, it would not only pay handsomely itself, but would add considerably to the value of their mines.

In conclusion I am afraid I have given you the opportunity of saying that this paper is like the road to heaven " paved with good intentions," but I hope at some future date, to add a rider to it, going into costs minutely, and clearing up one or two points I have left rather in a haze.

DISCUSSION.

MR. HARDMAN said he was sure that the people who were interested in gold mining were under great obligations to Mr. Mason for his paper. The suggestion contained in the last part of the paper that the mines should combine in the erection of a central plant was a good one. When the number of mines that there were in this province were considered, and it was remembered that there never yet had been a successful attempt made to treat the sulphurets, language failed him to say what the state

of mind of the gold miner should be. Mr. Mason had demonstrated that the sulphurets obtained were of sufficient value to pay handsomely for treating them.

MR. C. E. WILLIS said that he had thought that a concentrating plant would be a good thing, but recently, in looking over the returns in the Mines Report, he was led to the belief that the thing was smaller, perhaps, than it had been thought. The mines of Nova Scotia were scattered over a large extent of country, and a good deal of the stuff to be concentrated would be of low grade, while the facilities for carring it were not good and the question was whether it would pay, providing every ton was saved. It would be impossible to get all. About one-third might be taken off, which would reduce the quantity available to 600 tons. Would this pay.

MR. HARDMAN said that he would be glad to buy all that was offered. He did not think there was any doubt that if 1,000 tons could be obtained it would pay very well to treat it in a central plant.

MR. MASON said that the plant was not expensive.

CAST IRON TUBBING IN THE SHAFTS AT SYDNEY MINES, C. B.

BY MR. R. H. BROWN, SYDNEY MINES.

I had first intended to confine myself to a description of the Cast Iron Tubbing put into the shafts known as the Princess Pits of the Sydney Mines, the property of the General Mining Association of London: but it seems desirable also to give a short account of the sinking of those pits, as intimately connected with the subject of the tubbing.

There are two pits sunk to the coal, namely: the B pit or winding shaft, of 13 feet diameter and 682 feet in depth; and

the C pit or pumping shaft, of 11 feet diameter and 709 feet deep to the bottom of the sump, 22 feet below the seam of coal; there is also a staple or auxiliary pumping pit, sunk to a depth of 389 feet from the surface. A drift from the bottom of the staple connects it with the C pit. In pumping, the water is raised from the sump in the C pit a height of 332 feet to the drift, whence it flows into the staple sump, and is pumped thence, a height of 346 feet, to the delivery drift, situated at 42 feet below the surface. The water runs through this delivery drift, a distance of 516 feet, to the shore of Sydney Harbour.

The sinking of these three shafts was commenced in the spring of 1867, and when, in the year 1868 a depth of some 200 feet had been reached, a feeder of water was met with, which made it necessary to provide pumping power. A set of 8 inch pumps, worked by a small horizontal engine, was then erected, which coped successfully with the water for a time; but soon more water was encountered, so that sinking operations had to be again suspended until the main pumping engine should be imported and set up. Sinking was then recommenced and progressed until a heavy feeder of salt water was met with in the pumping shaft at a depth of 267 feet from the surface. This water came through fissures in the thick bed of sandstone direct from the sea; it was therefore found necessary to shut off the water by lining the shafts with cast iron tubbing.

A quantity of tubbing was then cast, and after 192 feet in depth of the pumping shaft, and 150 feet in depth of the staple, had been tubbed, and the upper feeders of water first met with had been thus shut off, a struggle was made to sink through the water-bearing strata, the extent of which in advance was unknown. Our pumping engine, of the Cornish type, with cylinder of 62 inches diameter by 9 feet stroke, had been erected; and now a sinking set of pumps of 20 inches diameter with the necessary outfit of pumping spears, ground spears, ground ropes, sheaves and crabs, was fitted up. The sinking was then pushed on, and during many months we had as much as 650 gallons of water per minute to pump day and night.

while the sinkers worked putting in their shots around the windbore or suction pipe; the water rising two inches in the shaft after a stroke of the pumps before another stroke could be taken. The buckets and clacks had always to be changed by drawing them up through the pumps, for the influx of water rising in the shaft at the rate of 13 inches per minute, gave no time for taking off bucket or clack doors for changing in the usual way.

At length the wet beds of sandstone and shale were passed through, and a bed of dry solid sandstone was reached at a depth of 323 feet down from the surface.

A wedging crib was bedded in this sandstone, and the shaft was tubbed up thence a distance of 92 feet to the bottom of the tubbing that had previously been put in.

When the pumping shaft and staple had been tubbed, they were sunk almost dry for the remainder of their depths, to completion The sinking of the winding shaft was then resumed; the feeders of water met therein, being passed to the pumps in the C. Shaft by means of a borehole from the bottom of the former. The tubbing of this shaft was effected as soon as the wet strata had been sunk through, and the balance of the sinking was completed dry to the coal.

Drawing No. 1. shows a section of the shafts on a small scale; No. 2. shows a segment of tubbing for the pumping shaft, and No. 3. shows a segment of Crib.

The tubbing is cast in segments of 24 inches deep, except where closers of a less depth are required, and in length convenient for handling, and depending upon the circumference of the pit; thus, 9 segments complete the circle in the B. or winding shaft; 8 segments in the C. or pumping shaft; and 5 segments in the staple.

The tubbing is put in by lifts; a lift consists of a crib, and from 5 to 50 courses of tubbing built up thereon.

The situation of each crib depends upon a good hard stratum of rock being met with suitable for a crib bed.

This bed has to be dressed down with chisels with much care, and cut to a perfectly level and even surface.

When the crib, of 8 or 9 pieces as the case may be, has been laid thereon and wedged up securely, the segments of tubbing are built upon it, breaking joints with each other like bricks on edge. Each segment of tubbing has a flange of 4 inches in depth all around it as a support for the wedging. Gluts of pine wood ½ inch thick, are inserted between both vertical and horizontal joints, and each course of tubbing has a backing of wood wedges driven behind it, to keep it firmly in place, and to resist the force necessary in driving the joint wedging.

When a number of courses of tubbing have been set up in place, then all joints are wedged up; that is, small wedges of red pine are inserted in the glutting and driven in until the wood becomes compressed so hard, that the chisel edge cannot any longer be driven into it.

Air would collect behind the tubbing, and by its elasticity under pressure would subsequently tend to blow out some of the wedging. To guard against this, there is a brass 4 inch valve placed in each crib at the back of the tubbing, to allow the air to pass freely from the lowest to the highest lift. Also each segment of tubbing has a hole of 1¼ inches diameter through its centre, to let the air escape during the process of wedging; these holes are plugged when the wedging of the joints is completed.

The quantity of tubbing used in shutting off the feeders of water in the shafts was considerable.

In the C, or pumping shaft, 284 feet in depth were tubbed in 5 lifts, using 40 segments of cribs and 178 segments of tubbing, the weight being 569,639 lbs. of cast-iron.

In the B, or winding shaft, 273 feet 4 inches in depth, were tubbed in 4 lifts, using 36 segments of cribs and 1,233 segments of tubbing, the weight being 658,724 lbs.

In the staple shaft, 283 feet 6 inches, were tubbed in 5 lifts, using 25 segments of cribs and 711 segments of tubbing, the weight being 323,975 lbs.

This quantity of tubbing, over 776 tons, of 2000 lbs. to the ton, in all, was cast at our own colliery foundry and consumed 419 tons of pig iron, imported from England, and 419 tons of scrap cast iron obtained in this county.

As there were 19923 linear feet of joints in the tubbing to wedge up, and as about 24 wedges were used for every foot, it can be seen that quite a quantity of pine timber had to be cut up for this purpose, as well as for the glutting.

I may add that, finding the untubbed portion of the pumping shaft beginning to waste away, owing to the disintegrating action of the water from the pumps and the heat from the partially condensed exhaust steam from our haulage engines, we have, during the last two years, lined other 309 fee in depth of that shaft with cast iron tubbing. This was put in in three lifts, using 340 segments of cribs and tubbing, weighing 388,316 lbs.

This tubbing, not having to resist a pressure of water, was made lighter than what had been previously put in above, the joints were not wedged further than was necessary to keep the tubbing in place, and the cavities in the sides of the shaft behind the tubbing were filled up with fine gravel from the beach.

Again during February last we lined the sump portion of the staple shaft for 8 feet 2 inches in depth with tubbing, using 27 segments or 8121 lbs. in weight.

Thus altogether a depth of 1158 feet 8 inches of these shafts have been lined with cast iron tubbing weighing 974½ tons.

The pumping shaft is fitted up with buntons and guides for the cages by which the colliers and others descend and ascend to and from their work. The buntons are placed at intervals of 6 feet apart vertically in the shaft. In casting the tubbing this was kept in view and pockets were formed on the segments at proper intervals to receive the buntons. This was found to make a much better job than the plan, before adopted, of having

to spike cleats to the wedging of the tubbing for the reception of the ends of the buntons.

I ommitted to state above that, in casting the tubbing the thickness of the plate or back is made to correspond with the pressure it has to bear; for the lowest lift, where it had to withstand the head of 284 feet of water, it was made $\frac{7}{8}$ inch thick and was reduced as it ascended and had less pressure to bear.

DISCUSSION.

MR. H. S. POOLE said that the experience at Sydney Mines would be valuable to others who had to adopt this method of keeping back water. He remembered going down the shaft and seeing the stream of water that was coming in. He would like to ask Mr. Brown what percentage of the tubbing broke under the hammer when the sections were being tested, preparatory to putting them in.

MR. R. H. BROWN replied that he did not think any was broken in that way. Some sections were spoiled by cinders getting in when the metal was being melted. They had a first-class foundryman and a great deal of the credit for the success was due to their engineer.

MR. H. S. POOLE mentioned a thrilling experience in connection with this mine. A tub was going up with a man in it and caught on the edge of a bracket when it was 70 feet from the bottom. The man was thrown out and fell to the bottom of the pit, landing on his feet, and singular to say, without any serious injury.

MR. R. H. BROWN said their was no doubt that the man fell the entire 70 feet. He was laid up some three weeks with sore ankles, but otherwise, escaped injury.

MR. W. BLAKEMORE, (Cardiff) said that he was pleased to have heard such an eminently practical paper. In England the greatest difficulty arose not in passing through wet rock, but in going down through running sand, of which there was a great deal in the old country. Before tubbing was resorted to, it was extremely difficult to get through it. He remembered one pit in Staffordshire that they were working at for ten years. In that case they drove piles around the shaft as best they could. This was superseded by tubbing in connection with piling. He knew of one case where wooden tubs were used, but where there was any considerable depth the only system was that of cast iron tubbing. He would like to ask whether at Sydney Mines the tubbing had been tested by hydraulic pressure.

MR. R. H. BROWN replied that it had been tested only by hammer.

MR. BLAKEMORE said that in 1873, in England, a Belgium process had been tried. The bed of coal to be reached lay under conglomerate and the cost of sinking was very great. The sinking was done without pumping the water out. The implement used was a huge crossbar filled with as many as 20 or 30 steel drills, 3 feet in length, and two inches in diameter. This apparatus was continuously dropped and hoisted again. By this process a shaft 170 yards deep was sunk through heavily watered conglomerate and the core bored out, leaving a clear cylinder. The process was perfectly successful in carrying the work down, and in acheiving all that the Belgian engineers claimed for it. When they got into dry ground the tubbing was let down a little at a time until the whole was lowered to the bottom and seated in the dry ground. The Company had expended £110,000, and were anxious to get coal as quickly as possible, and when they got 6 or 9 feet into the dry strata, they wanted to know if that was not enough. The engineers wanted to go down much deeper, but when they got down 12 feet the company commenced to blast at the bottom, and the force of the blasts combined with the pressure of the water had such an effect that the next morning the water was at the surface, and there

it was to day. Although experimentally the system was correct, it was not an economic success and would never be repeated. Since then shafts had been sunk in the same way that Mr. Brown had described. This had been done with perfect success and at half the cost of the Belgian process. It was gratifying to him to learn that the same difficulties which were met with at home were successfully dealt with here, and in the way that was regarded in England as the best possible.

MR. CHAS. ARCHIBALD said that in the district that he represented, they were not troubled so much by the quantity of water as by its quality. It was too acid.

MR. H. S. POOLE said he understood that at one of the pits of the Dominion Coal Company, Mr. MacKeen had adopted the plan of building up a wall of cement to keep back the water.

MR. DAVID MACKEEN, M.P., on being called upon, said that there was not much to relate. When they got to hard rock they found that there was a large inflow of water, and decided upon walling the shaft with concrete. The work was carried through very sucessfully, and it was believed that it would be perfectly tight and substantial. The shaft was 24 feet long, and 10½ feet wide. It was intended for hoisting coal and lowering and hoisting men, and for taking down compressed air pipes for ventilation purposes. He was interested in Mr. Brown's paper as one of the most valuable seams of coal of the Dominion Coal Co. was near the sea shore. In connection with their work generally he would add that the Stanley coal heading machine had been used with very satisfactory results. It cut a very complete roof and there was little danger of the roof coming in. Besides this it was found that coal could be cut and delivered at a less rate than if taken out of the ordinary boards. The machine was driven by compressed air and he thought it would work quite a revolution in our mines. The coal could be cut in six foot tunnels and put into tubs for 22 cents a ton where the miners were paid 41 cents. In some places 60 cents was paid. That did not include interest on capital. If the Society could make it convenient to meet in Sydney next summer he believed he was voic-

ing the sentiments of all who were interested in the mines in saying that they would be pleased to show members who came, the works and seams, and he believed that there would be novelty enough about it to make it interesting.

MR. R. H. BROWN said that he would be most happy if the Society would come down.

MR. B. T. A. BELL at the same time took the opportunity of inviting members of the Society to attend the meeting of the General Mining Association of Quebec at Montreal on the 11th and 12th of January.

THE ASBESTOS FIELDS OF PORT AU PORT, NEWFOUNDLAND.

BY C. E. WILLIS.

The metamorphic rocks and serpentines, of the Eastern Townships of Quebec, and the Gaspé Peninsula, in which the Canadian asbestos, or more correctly speaking chrysotile, is found, dip under the Gulf of St. Lawrence, appear again on the west coast of Newfoundland, and extend many miles inland, probably entirely across the island, though in places, specially on the great elevated central plateau, they are capped with granitic rocks, and seemingly have disappeared.

Here and there, also, are great mountains of magnesian limestone, and in the region of the Grand Lake, and other isolated sections, are found carboniferous basins, with small seams of very good bituminous coal. Still this entire area, extending about 100 miles north and south, and the entire width of the island east and west, can be safely called a serpentine country, and contains according to Mr. James P. Howley's estimate, 5097 square miles of serpentine rocks.

The region is exceedingly rugged and picturesque. Cut by

deep gorges and ravines, with towering and precipitous mountains, and craters of extinct volcanoes, with streams and lakes of the most crystal clearness, and everywhere cascades, of from a few feet to many hundreds of feet in height, combine to make a district of surpassing grandeur and interest, not alone to the mining engineer, but to any one who loves nature in its wildest moods.

The serpentines, with the granulite dykes which everywhere intersect them, contain vast deposits of minerals, and are to-day nearly virgin fields, except on the immediate coast line, for the prospector and miner, and certain to become in the immediate future, the seat of great mining operations.

That the country has not long ere this taken a first rank as a mineral producer, is due to its former isolated position, difficulty of access, except in small sailing vessels, and other ulterior causes; but now, with regular and frequent steam communications, the prospector and engineer are forcing their way into the country, and soon it will be the scene of prosperous mining camps, and a large mining industry.

The minerals met with are copper, which is found everywhere, magnetic hematite chromic and specular iron ores, coal and petroleum, gold, silver and lead, nickel, iron pyrites, antimony, marbles, gypsum, mica and asbestos; and it is to the latter that I shall devote a few remarks.

The existence of asbestos in this great belt of serpentine has long been known, or supposed, and several well known geologists, in their writings as far back as ten and fifteen years ago, have predicted that it would be discovered in quantities sufficiently large to be of economic value, but it has only been within the past three years that the attention of the miner has been turned in this direction, and it is now attracting much interest in the Island.

On the eastern coast of Port au Port Bay, rising out of the sea to a nearly vertical height of 1800 feet, is a mountain known as Bluff Head.

This mountain determines the southern boundary of the serpentines.

For many miles north the coast line is precipitous and lofty, culminating at Cape Gregory in a bluff nearly 2500 feet high.

At Bluff Head, and extending for about one mile north, the beach is composed of conglomerate, very hard, and highly polished on the surface by the action of the surf which breaks upon it. The beach is strewn with bowlders of all sizes which have fallen down from the cliffs, and nearly all of them contain seams of asbestos, while the conglomerate of the beach itself is filled with it.

It was here the asbestos first really attracted much notice.

Long known to the fishermen of the neighborhood as "cotton rock" it came to the knowledge of the Hon. Daniel Cleary of St. Johns, who, some three years ago, equipped a small expedition to do some prospecting in the neighborhood.

The success met with was so immediate and marked, that other claims were immediately secured, till in a short time some 30 square miles were taken up by prospectors, and speculators, and the past summer has witnessed a large amount of development work.

Much of this work has been of the most satisfactory nature to the owners, and proves the field to be a large and valuable one, but from my observations a very large part of the district now held under leases and license. will be valueless as far as asbestos is concerned, but this always is the case in a new mining country where speculators rush in, and secure claims, without having previously been on the ground.

About one year ago I visited the district, and secured claims on what promised to be valuable asbestos ground. and with this as a basis to start on, the Halifax Asbestos Co., Ltd., was organized.

The property consists of two areas of 640 acres each, each containing one square mile, and situated on both sides of a deep gulch, or ravine, the dividing line being lengthwise through this gulch.

The ravine mentioned runs in nearly a true north and south course, from the shore inland for about 5 miles, where it is cut at right angles by the valley of the Fox Island River, and terminates at the inner end in this valley.

The sides of the gulch are very precipitous, having more slope where we have been working this summer than elsewhere, and rise to an elevation of 1700 feet on one side, while on the other they in places reach to a height of over 2000 feet. The walls are nowhere, I think, in the entire length of the valley, less than 600 or 700 feet high. It might be said of the property, that it is an ideal one for mining, as no hoisting engines, or pumping, will ever be required in the future operations of the company.

The claims are about three and one-half miles from the sea by the gulch, though but little more than two miles in a straight line from the shore; we will, however, reach the shore in the future through the valley of the Fox Island River, which, though it makes a somewhat longer route, brings us to the shore at a fine shipping point, and admits of the building of a road with very easy grades, in fact none whatever to speak of.

The government of Newfoundland being keenly alive to the necessity of fostering its mining industries, has undertaken to construct a good road by the route we desire, to connect with the point of shipment, the government railway, now under construction, and the settlements of Port au Port and Bay St. George. This road will accommodate all the claims in the district.

Active development was started on the 7th July and continued till late in October, with the most satisfactory results. The work extended over many hundreds of feet along the gulch, and some ten or twelve large cuts were made in the mountain side, through the surface drift. In each opening, quantities of asbestos was found as soon as the rock was reached, while the surface drift, which varies from three to twelve feet in depth, is everywhere filled with loose fibre, entirely free from the

matrix, the result of the decomposition of the serpentine, through the action of the frosts, and weather.

The fibre runs up to 2½ inches in length, and is of the most beautiful quality, and difficult to distinguish from the Canadian product.

In fact, the peculiar green tinge of the asbestos, the color and composition of the serpentine, the granulite dykes and many other geological peculiarities, go to prove the remarkable similarity of this region with the Eastern Townships of Quebec, where the Canadian chrysotile mines are located. The company is much pleased with the success which has met its first efforts, and will begin mining operations on a large scale in the early spring.

In many places where the cliffs are denuded, seams of asbestos can be seen running through the rock, and as these exposed places can be found from the foot, to the top of the hill, it proves the entire mountain side to be asbestos bearing.

There are three remarkable water-powers on the property, from any one of which a head of from 1000, to 1200 feet, can be obtained, to operate power drills, and necessary machinery for dressing the short fibre.

While we have been developing our property, we have had as neighbors the Newfoundland Mineral Syndicate, an English Co., who own the areas next our own, and who started operations a short time previous to our beginning.

They also have met with most satisfactory results, and I was informed by the engineer in charge, they were more than satisfied with their season's work. Their areas also contain very large deposits of copper, hematite, and specular ores. One vein of specular, some 20 feet wide, is cut in many places by seams of asbestos, which, to myself at least, is unique, and I should be glad to hear if such a thing has heretofore been observed.

A large amount of work has also been done on the Cleary claims, where a like satisfactory result has been met, while owners of other areas have been looking over their ground, and have done some prospecting on a small scale.

The summer's work proves the value of the field beyond question, and it will at once come to the fore as a factor in the world's supply.

Labor is both abundant and cheap, and supplies can be readily obtained, and landed from vessel within a short distance of the mines.

With water transportation at hand for the product, cheap labor, and being much nearer the European markets than the other sources of supply, the operators will be enabled to successfully compete with mines in other counties.

DISCUSSION.

The Chairman asked Mr. Fletcher whether any rock of a similar character had been noticed at Cape North, C. B.

MR. HUGH FLETCHER said that he had listened with much pleasure to the paper read. In reply to the question asked by the President, the chrysotile found in Nova Scotia differed from that described in the paper in being derived from hornblende and in not being true asbestos. It was found between Sydney and Louisburg in Cape Breton, and also on the north side of the Bay of Fundy, at Harrington River, and at Lynn. He thought that the fibre was too short to be of any economic value, and that the rock was found in too small quantity. His attention had been called by Mr. John Rutherford of Stellarton, to the occurence of asbestos in the trap rock at Clementsport on the Bay of Fundy. Mr. Rutherford examined it, but did not see a sufficient quantity.

MR. B. T. A. BELL said it had given him great pleasure to hear Mr. Willis' description of this new source of asbestos. The paper would be scanned with much interest in England and in the United States. The Canadian asbestos industry as they all know, was confined to a comparatively small area in the Eastern Townships of Quebec, and had for a number of years proved highly remunerative, although during the past two years owing

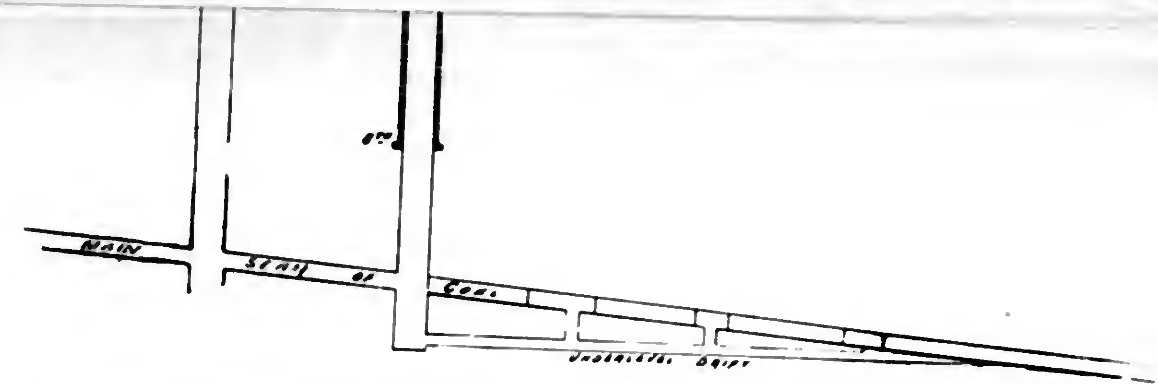
to competion from other sources the prices realized had fallen very considerably. Italy, Russia, and South Africa, were each contributing to the world's supply, but he ventured to say that the quality of the fibre from these countries was vastly inferior to that produced by Canada. The sample of crude from South Africa on the table would illustrate the great inferiority of that product compared with Canadian, yet manufactured goods were being made from it and sold in England at one-half cost of Canadian and Italian. A new source of asbestos is also reported to have been found in Arizona in the United States. So far, however, the quality of the asbestos from these different fields is of much lower grade, and we doubt not but that the Canadian product will continue to hold its position of first place against all other competitors. Murray in one of his reports to the Geological Survey, pointed out many years ago the likelihood of asbestos being found in economic quantity in Newfoundland. Dr. Ells of the Survey had also more recently visited the colony, but he was not aware that his report had been published. He had seen samples from the Cleary mine, Port au Port Bay, but developments there and indeed at any of the mines had not yet demonstrated that any serious fears need be entertained by the Canadian producer of the quantity or quality of asbestos to be produced from this new source.

MR. JOHN J. PENHALE (United Asbestos Co.) Black Lake said that he heard of the Newfoundland asbestos two years ago, but the people who were looking into it then were not so frank as Mr. Willis. He had seen samples taken from the Newfoundland deposits and thought they were good, and somewhat similar to the Canadian samples. He understood that the work so far had been purely of a preliminary character and that nothing but the surface deposits had been opened up. It should be remarked, however that experience had shown that no material improvement in quality was found at depth, the fibre being much the same.

A NATIONAL MUSEUM WANTED.

MR. B. T. A. BELL.—Those of the members of the Society who participated in the proceedings of the Mining Convention at Montreal will remember that one of the resolutions unanimously adopted there related to the necessity of larger and more adequate accommodation for the magnificent collection of the Geological Survey at Ottawa. The building was not only too small for the wants and uses of this most important branch of the public service, but its surroundings endangered its destruction by fire. Only during the past few days the building had been found to give indications of falling in and a force of men were at work putting in additional support. The time had arrived when the Dominion Goverment should provide a building more suited to the requirements of this valuable public collection. The Boards of Trade in Upper Canada were pressing the matter on the attention of the authorities, and he thought the Society might contribute its influence to the same end. He would move a resolution to that effect and that a copy of it be forwarded by the Secretary to the Hon. the Minister of the Interior and also to the various members of Parliament in the Province.

MR. JOHN HARDMAM seconded the motion which was carried unanimously.



Section of Shafts and Tubbing at the Princess Pits, Sydney Mines, Cape Breton.

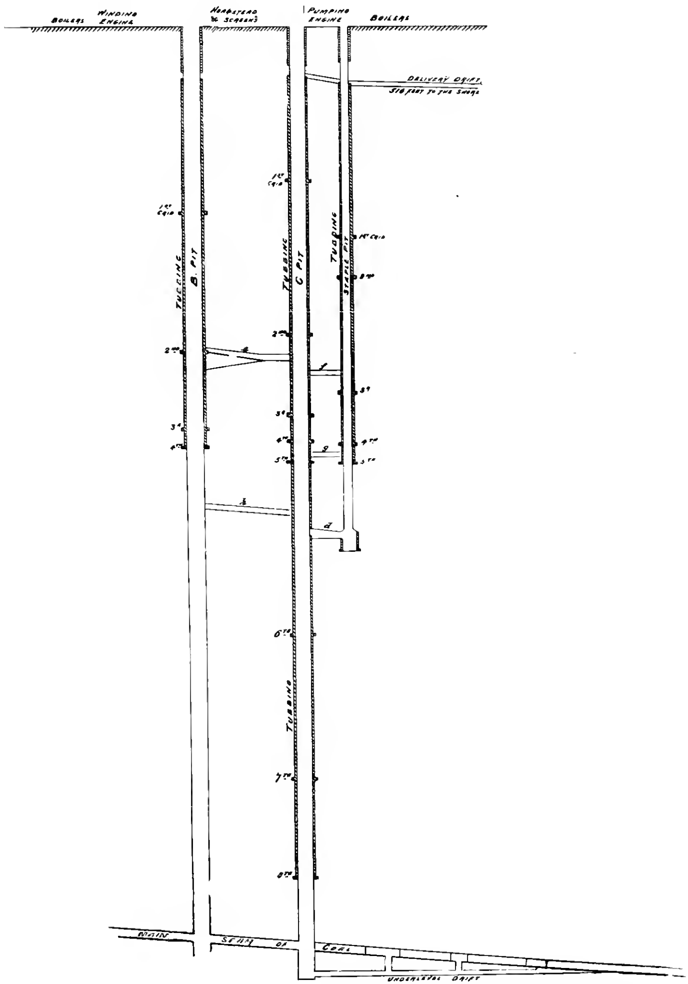
Scale, 40 feet to 1 inch.

d Drift through which the water flows from pumps in C shaft to pumps in Staple Shaft

e. f. g. h. Drifts made between the shafts to facilitate the process of sinking; these drifts are now closed off by the tubbing.

Plate I. Illustrating Paper by Mr. R. H. Brown, "Cast Iron Tubbing at Sydney Mines, C. B."

(Accompanying PART IV, VOL. II.)



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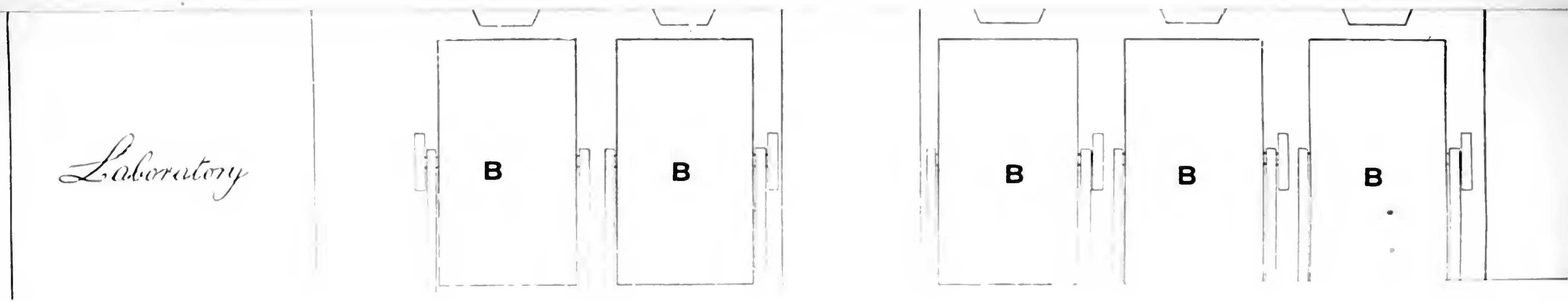
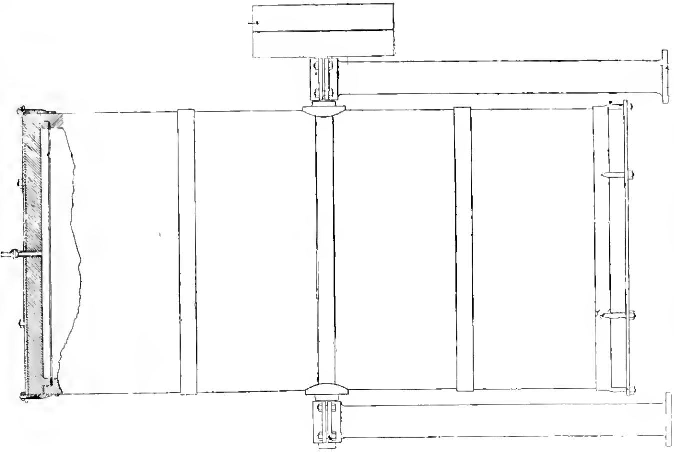
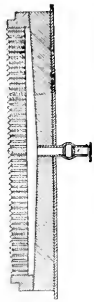

Laboratory
B
B
B
B
B

Plates I and II. Illustrating Mr. F. H. Mason's Paper,
"Gold Chlorination — A description of the Newbury Vautin Process."

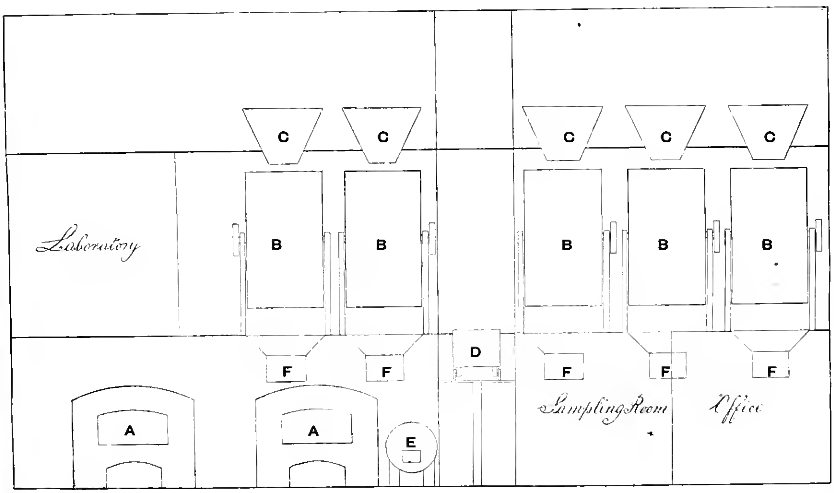
(Accompanying PART IV, VOL. II.)



Front Elevation of Chlorinator With Cover in Section.



Section through Filter Bed of Chlorinator



Skeleton Section through Chlorioation Works.

A A Furnaces
B B Chlorioators
C C Hoppers
D Lift
E Engine and Boiler
F Chutes

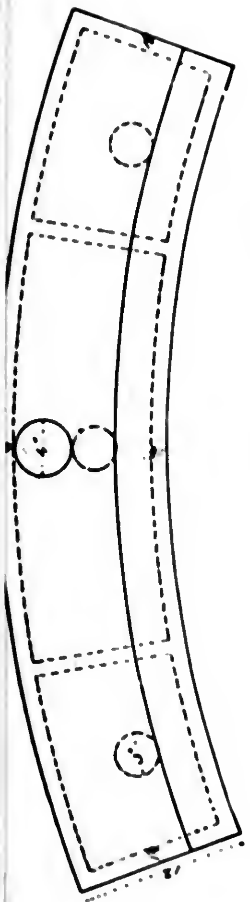
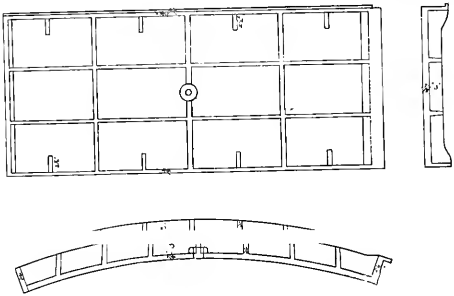


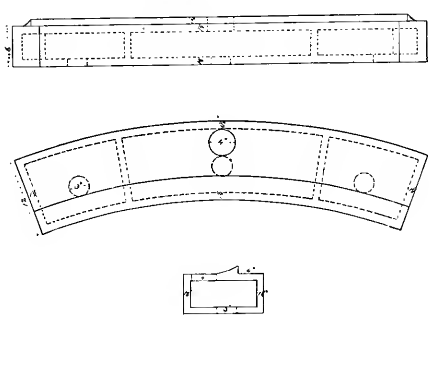
Plate II. Illustrating Paper by Mr. R. H. Brown, "Cast Iron Tubbing at Sydney Mines, C. B."

(Accompanying PART IV, VOL. II.)



Back elevation and sectional views of Cast Iron Tubbing as used in lining the Princess Pit shafts at the Sydney Mines.
The above represents a segment for the pumping shaft, cast with a radius of 6 feet 6 inches, as this shaft is 11 feet in diameter.

Plate III.



Sectional elevation and views of a segment of a Cast Iron Crib such as used to support the tubbing in the Princess Pit Shafts at the Sydney Mines.

Scale, $1\frac{1}{2}$ inches to 1 foot.

A SCOTIA.

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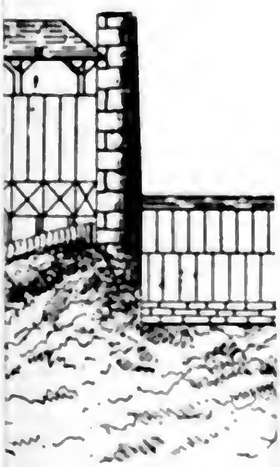
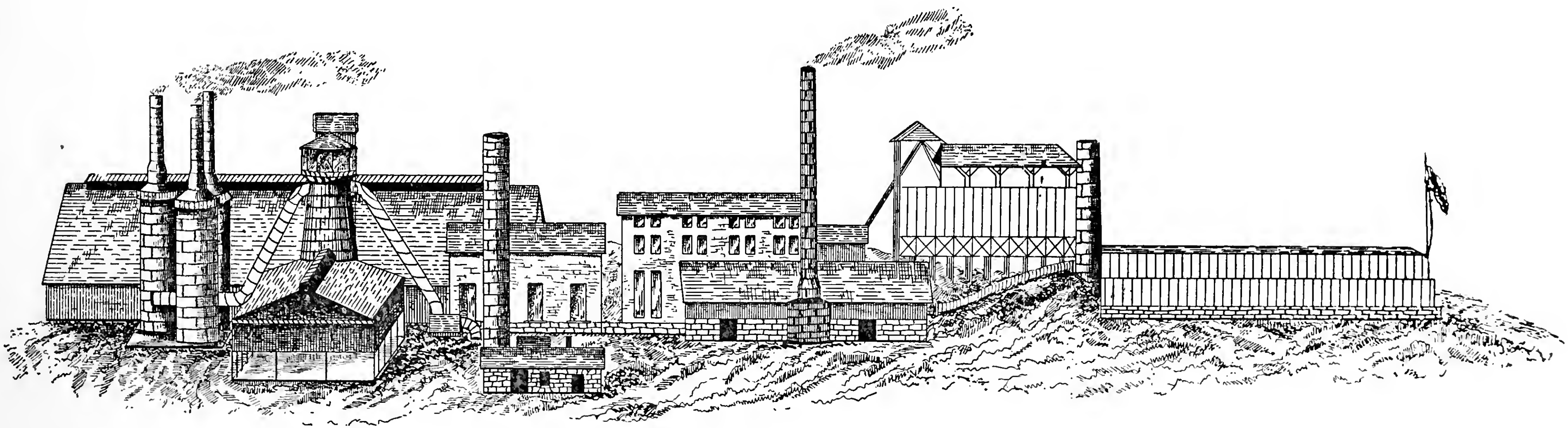


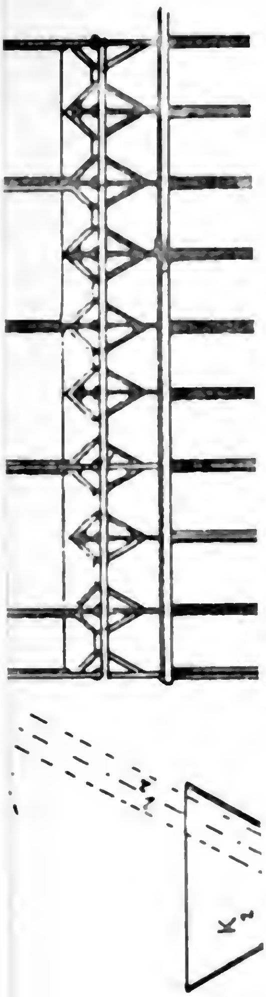
13.
14.
15.
16.

New Glasgow Iron, Coal and Railway Company, Ltd.

Exterior View of Furnace Plant at Feronna, Nova Scotia.

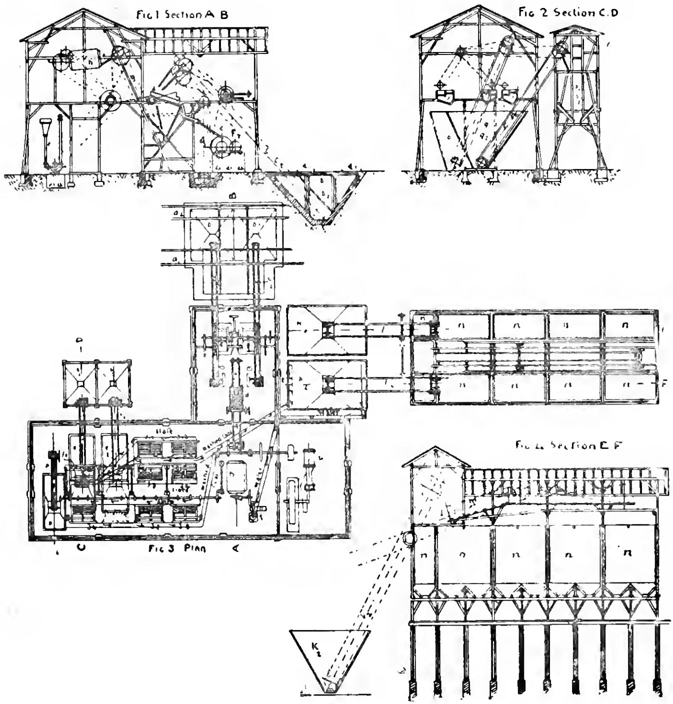


1. Blast Furnace.
2. Blast Tower.
3. Hot-Blast Stoves.
4. Slack House.
5. Cast House.
6. Engine House.
7. Stand-Pipe.
8. Blacksmith's Shop.
9. Boiler Chimney.
10. Coal Washing Building.
11. Coal Storage Tower.
12. Boiler House.
13. Retort Coke Ovens.
14. Pig Iron Track.
15. Cinder Track.
16. Slack House Track.

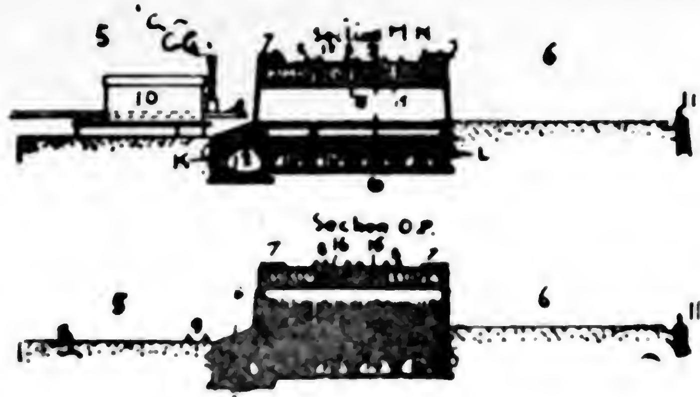


New Glasgow Coal, Iron and Railway Company, Ltd.

General Plan & Description of Coal Washing Plant of The New Glasgow Iron, Coal & Railway Co. Ltd. Ferrona, N. S. Canada.



*A*1-*A*2—Railroad Tracks for arrival of coal from different mines.
*B*1-*B*2—Double Dumping Pit, so arranged that each kind of coal may be dumped separately.
*C*1-*C*2—Bucket Elevator to take coal from B1 and B2 to Shaking Table (Screen D).
D—Shaking Table Screen, with double eccentric motion, imitating hand screening as much as possible. The mesh of the perforated screen plate is ½ inches.
*E*1-*E*2—Crushing Rolls, to crush the coal too large to go through the Shaking Table (Screen D).
F—Bucket Elevator, to elevate the crushed coal again to Shaking Table (Screen D).
G—Bucket Elevator, to take the coal which passes through the Shaking Table (Screen D) to
D—Separating Drum, which separates the coal into three sizes, 0 to ⅛ in., ⅛ in. to ¼ in., ¼ in. to ½ in.
*J*1-*J*8—Two-Compartment Fine Corn Coal Jigs. The coal chutes from the Separating Drum H to these Jigs. The washed coal from the Jigs flows into
*K*2—Elevator Boot, and is taken from there to top of Storage Tower by mevns of
*L*2—Perforated Bucket Elevator, which discharges the coal on
M—Conveyor Band, which distributes the coal into
N—Compartments of the Coal Storage Tower.
The Jigs shown in dotted lines and
*K*1—Elevator Boot,
*L*1—Perforated Bucket Elevators, are contemplated to be put in if a larger capacity is required.
The Slate from Jigs J1 to J8 is discharged into
*Q*1—Elevator Boot, and is taken by
*R*1—Perforated Bucket Elevator into
*S*1—Slate Storage Tower.
*J*5—Jig can be arranged to re-wash the Slate if necessary. In case the slate is to be re-washed it is discharged into
O—Elevator Boot in place of Q1, and is taken to Jig J5 by means of
P—Perforated Bucket Elevator. The Jig J5 discharges the final Slate into the Elevator Boot Q1, from whence it is conveyed by means of Perforated Bucket Elevator R1 to Slate Storage Tower S1.
The coal obtained from the re-washed product can either go with the washed coal to Elevator Boot K2, or be discharged into
*Q*2—Elevator Boot, and be taken by
*R*2—Perforated Bucket Elevator to
*S*2—Storage Tower, if the percentage of ash is too high for coking purposes.
T—Centrifugal Pump, to which all the water returns from the Elevator Boots, and is used over again.
U—Steam Engine.
If the Slate is not to be re-washed the Jig J5 can be used for washing coal.

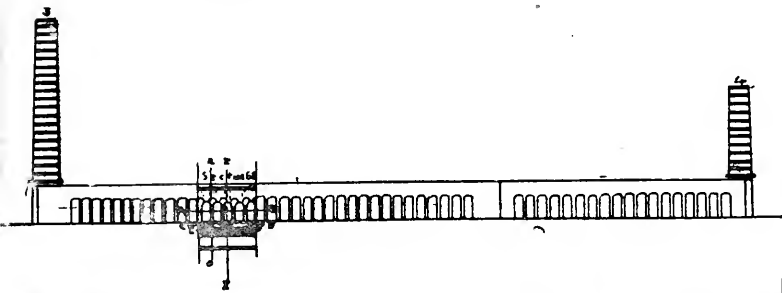


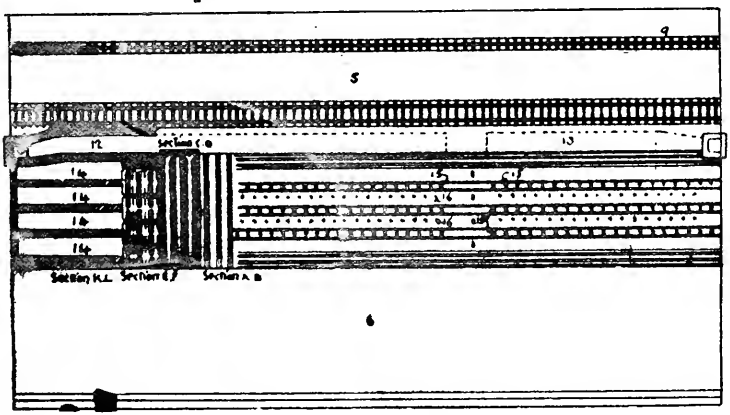
Double Battery of 54 Retort Coke Ovens,
Bernard's System.

of the New Glasgow Iron, Coal & Railway Co. Ltd.

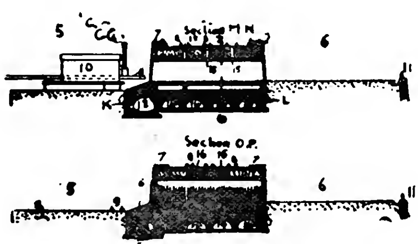
Ferrona, N.S., Canada.

New Glasgow Iron, Coal and Railway Company, Ltd.





1	Battery of 36 Retort Coke Ovens
2	" " 18 " " "
3	Chimney for #1
4	" " #2
5	Side of Coke Pushing Machine
6	Coke Discharge Side
7	Tracks for windlass for raising Doors of Ovens
8	" " Larries " charging Coal
9	" " Coke pushing Machine
10	Coke Pushing Machine
11	Water Supply
12	Main Gas Flue of #1
13	" " " " #2
14	Air Flues
15	Charging Holes
16	Air.



Double Battery of 54 Retort Coke Ovens,
Bernard's System.
of the New Glasgow Iron, Coal & Railway Co Ltd
Ferrona, N.S., Canada.

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PORTION OF

Transactions of the Mining Society of Nova Scotia.

PORTION OF THE DISTRICT OF OLDHAM

Mapped as suggested in paper on "Government Aid to Mining"

(Accompanying Part III., Vol. II.)

A

The Main Shaft on this lode has a depth (on the incline of 43°) of 475 feet. At 150, 250, 350 and 450 feet respectively levels have been carried off cross-cutting through the 112 ft. fault and extending easterly to the 120 ft. fault, westerly to various lengths; the 150 ft. level runs westerly to point beneath letter X. The red dotted line represents the horizontal projection of the inclined shaft.

The pay chute was cut in this shaft at a depth of 230 ft., the quartz measuring from 10 to 15 in. in thickness and worth 17 to 35 oz. per ton. For dip and characteristics of pay chute see map of underground workings on page —.

B

This marks the position of the "East Shaft," not now in use. Its depth is 483 ft., and it is cut by the levels running east from Main Shaft A.

Owing to curve of the lode this shaft and Main Shaft diverge in depth, and are 213 feet apart on the 450 ft. level. The pay chute crosses this shaft at 455 ft.; it was 14 to 16 inches in thickness, and yielded 40 to 80½ oz. per ton.

C

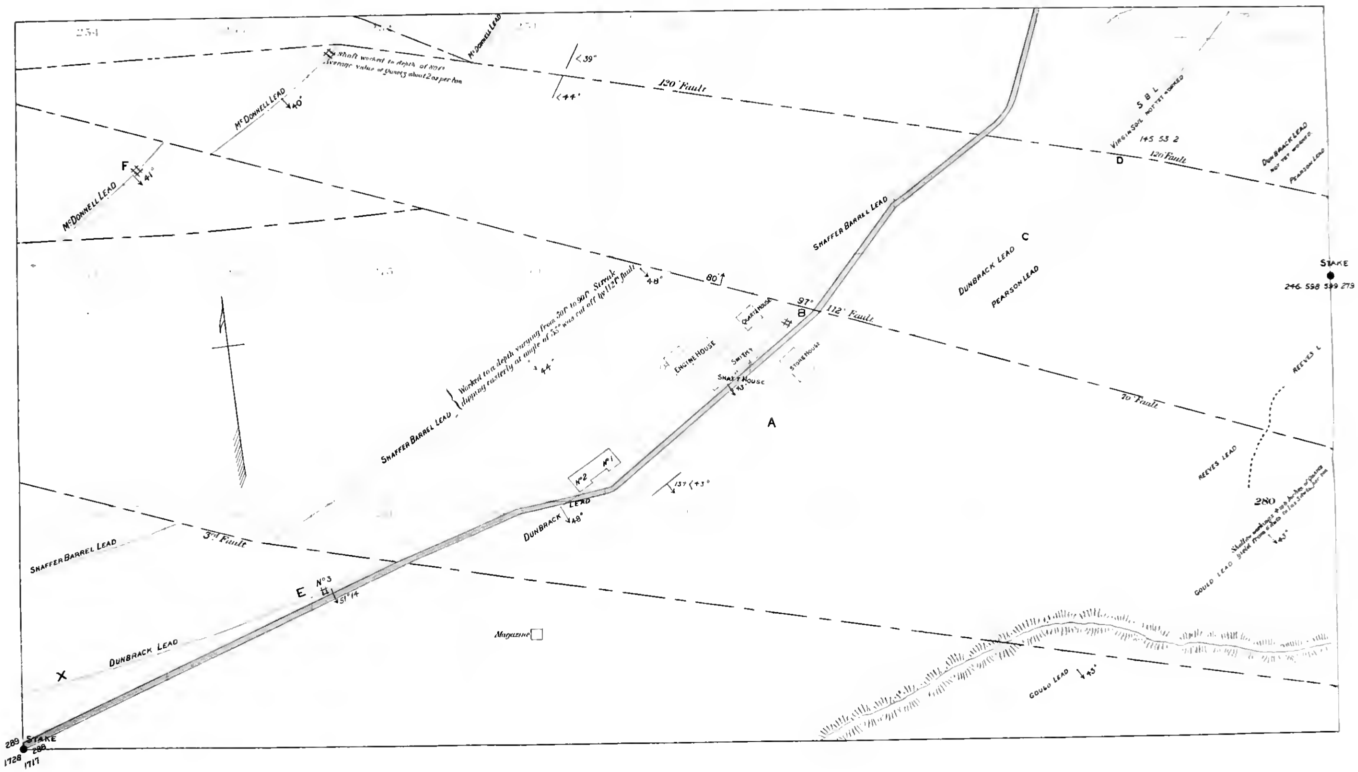
The ground between the two large faults is pierced by 4 levels, the 150, 250, 350 and 450, the two latter running to the 120 ft. fault. Ground above the 350 shows a lode from 4 to 10 inches in thickness varying from 7 dwts. to 2½-oz. per ton. This ground has been raised 95 feet by the upthrow of the 112 ft. fault, besides being shifted southerly 112 feet.

D

At the end of the 450 ft. level a winze was sunk 70 feet, cutting the pay chute here at a depth of 520 feet on the dip of the lode.

E

No. 3 Shaft, has a depth of 180 feet, connecting by the 150 ft. level east with Shafts No. 1 and No. 2, and the Main Shaft. Westerly the level has been extended 285 feet to a point below X. The chute was cut in this shaft at 136 feet in depth, the quartz was 16 inches thick worth 3½ oz. per ton. The ground above this level has been stoped out, and the beginning of the pay chute found at a point about 125 feet from surface and 50 feet west of No. 3 Shaft.



Scale 100 Ft = Inch.

J.E. Hardman, 27.9.93.